

# URBAN VISUALISATION

THE ROLE OF SITUATED TECHNOLOGY INTERVENTIONS

IN FACILITATING ENGAGEMENT WITH LOCAL TOPICS

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Thesis submitted in partial fulfilment of the requirements for the degree of Doctor of  
Philosophy at University College London

2017



## **Declaration**

I, Lisa Koeman, confirm that the work presented in this thesis is my own.

Where information has been derived from other sources, I confirm that this has been indicated in the thesis.

Signature: \_\_\_\_\_

Date: \_\_\_\_\_

# Abstract

Advances in computing have enabled the deployment of technology in public settings such as high streets, squares, and parks. The role such community technology can play in engaging and connecting people in the urban environment has become of increasing interest in recent years, amid widespread concerns that cities are becoming less socially connected. Till date, however, many of the studies have focused on displaying games, photos, and other entertainment content on public screens, with the aim of bringing people together through play. Less is known about the use of publicly situated installations as a tool for encouraging people to view the perspectives of others and to share their personal perceptions.

This thesis explores the use of situated public input technology and visualisations, collectively coined urban visualisation interventions, as a means of fostering community engagement. People's responses to and interactions with different topics, input devices, and visualisations were studied in a series of in-the-wild deployments in residential neighbourhoods and at events. In addition to the presentation of the design and evaluation of these deployments, this thesis presents an urban visualisation framework that outlines the key design and contextual factors that affect engagement, such as: the impact of the visualisation's update frequency on sustaining the community's interest, the influence of the input mechanism on the contribution quality, and the importance of positioning to ensure participation by a diversity of people.





# Acknowledgements

The completion of this thesis would not have been possible without the support and inspiration provided by my colleagues, friends, and family.

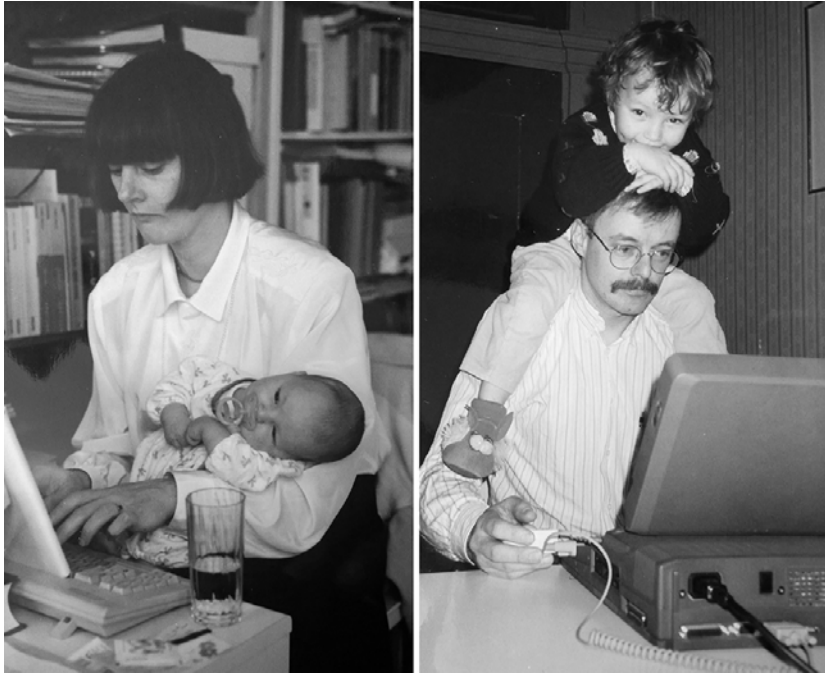
Thank you to Yvonne Rogers for creating a unique environment in which ambitious and experimental research is encouraged, and for giving me the opportunity to be a part of this. Throughout the process you have been more than generous with your time, advice, and support. Thank you for providing me with a good combination of freedom and guidance – it has been a privilege to work with you. Thank you also, Duncan Brumby, for providing a different perspective and helping make this work more balanced.

Thank you to everyone at UCLIC and ICRI Cities. Thank you especially to Sarah Gallagher: you have gone above and beyond to help out, and it was such a joy to work with you. Thank you to Vaiva Kalnikaitė, the way you approach projects is inspiring and showed me how to get things done. Thank you Hans-Christian Jetter, Paul Marshall, Mara Balestrini, Licia Capra, Nicolai Marquardt, Jon Bird, Geraint Jones, Lorna Wall, Connie Golsteijn, Martin Traunmüller, Martin Dittus, Sharon Betts, Rowanne Fleck, Steven Houben, Ben Bengler, Han Pham, and many others: you have all contributed to this work in some way, and I am incredibly grateful for your involvement.

Thanks to those who helped make the studies in this thesis happen, including Intel, for providing funding through an Intel Institute Studentship, Mill Road's community groups, UCL's Centre for Engineering Education, Croydon Council, Alex Taylor, Nicolas Villar (and family), Tomas Diez, and JJ Giwa-Majekodunmi. Thanks to all who took part and engaged with the interventions – you have been fascinating.

Thanks also to those who taught me Information Science and Human-Centred Interactive Technologies at the University of Amsterdam and The University of York – your dedication and enthusiasm inspired me to pursue a PhD.

Finally, thank you, Boat, for encouraging me to follow my own path, for keeping me sane(-ish) & for the constant supply of many bad jokes.



Dedicated to B&B, who introduced me to HCI at a very early age.

Thank you for everything, the *wilskracht* most of all.

# Publications

Part of the work described in this thesis has previously been published. An overview of the conference papers, workshop papers, and other types of publications is given below:

## Conference papers

1. Gallacher, S., Golsteijn, C., Wall, L., **Koeman, L.**, Andberg, S., Capra, L., and Rogers, Y. (2015). Getting Quizzical About Physical: Observing Experiences with a Tangible Questionnaire. In *Proceedings of the 2015 ACM International Joint Conference on Pervasive and Ubiquitous Computing (UbiComp '15)*, pages 263-273. ACM.
2. **Koeman, L.**, Kalnikaitė, V., and Rogers, Y. (2015). “Everyone Is Talking about It!”: A Distributed Approach to Urban Voting Technology and Visualisations. In *Proceedings of the ACM Conference on Human Factors in Computing Systems (CHI '15)*, pages 3127-3136. ACM. (Honorable Mention Award, top 5%)
3. Golsteijn, C., Gallacher, S., **Koeman, L.**, Wall, L., Andberg, S., Rogers, Y., and Capra, L. (2015). VoxBox: a Tangible Machine that Gathers Opinions from the Public at Events. In *Proceedings of the 9th International Conference on Tangible and Embedded Interaction (TEI '15)*, pages 201-208. ACM.
4. **Koeman, L.** (2014). An Exploratory Study into the Public and Situated Visualisation of Local Data in Urban Communities. In *Proceedings of the 2014 Companion Publication on Designing Interactive Systems (DIS '14)*, pages 173-176. ACM.
5. **Koeman, L.**, Kalnikaitė, V., Rogers, Y., and Bird, J. (2014). What Chalk and Tape Can Tell Us: Lessons Learnt for Next Generation Urban Displays. In *Proceedings of the 2014 International Symposium on Pervasive Displays (PerDis'14)*, pages 130-135. ACM.

## Workshop papers

6. **Koeman L.**, and Jetter, H-C. (2015). Who Should Lead the Development of Community Technology? Workshop ‘Designing Alternative Systems for Local Communities’ at the *ACM Conference on Human Factors in Computing Systems (CHI ’15)*.
7. Golsteijn, C., Gallacher, S., Wall, L., **Koeman, L.**, Capra, L., and Yvonne Rogers. (2014). Incentivisation as a Design Feature: Lessons Learned from VoxBox. Workshop ‘Exploring incentivisation in design’ at the *8th Nordic Conference on Human-Computer Interaction (NordiCHI ’14)*.

## Other publications

8. **Koeman, L.** (2014). An Exploratory Study into the Public and Situated Visualisation of Local Data in Urban Communities. Poster at *UbiHealth 2014*.
9. **Koeman, L.** (2013). The Use of Public Visualisations to Encourage Social Connectedness in Urban Communities. *UbiComp Doctoral School 2013: Proceedings of the ACM International Joint Conference on Pervasive and Ubiquitous Computing (UbiComp ’13)*.

Publications 1, 3, and 7 report part of the findings from the VoxBox studies, covered in Chapter 6 and 7.

Publications 2, 4, and 5 report the findings from the Visualising Mill Road study, covered in Chapter 4.

Publication 6 reports on the Data What?! workshop, which is described in Appendix A.

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# Chapter I

## Introduction

Computing has moved beyond the workplace and domestic settings, and is becoming more ubiquitous in public and semi-public spaces. The affordability, connectivity, and portability of this technology has inspired researchers and practitioners to investigate the different roles technology can play in streets, squares and parks. This area of study is more commonly known as ‘urban informatics’; the intersection of people, place and technology (Foth et al., 2011). Within urban informatics, a large variety of city-related studies are conducted, ranging from improving the efficiency of finding a parking spot (e.g. Yan et al. (2011)) to sensing and predicting shared bicycle usage (e.g. Froehlich et al. (2009b)). In addition to such sensing and optimisation applications, urban informatics studies also focus on social challenges, often motivated by the rise in concerns about social connectedness in cities (e.g. Putnam (1995a)). There has been less research, however, that has focused specifically on designing public technology with the aim of facilitating community engagement and participation.

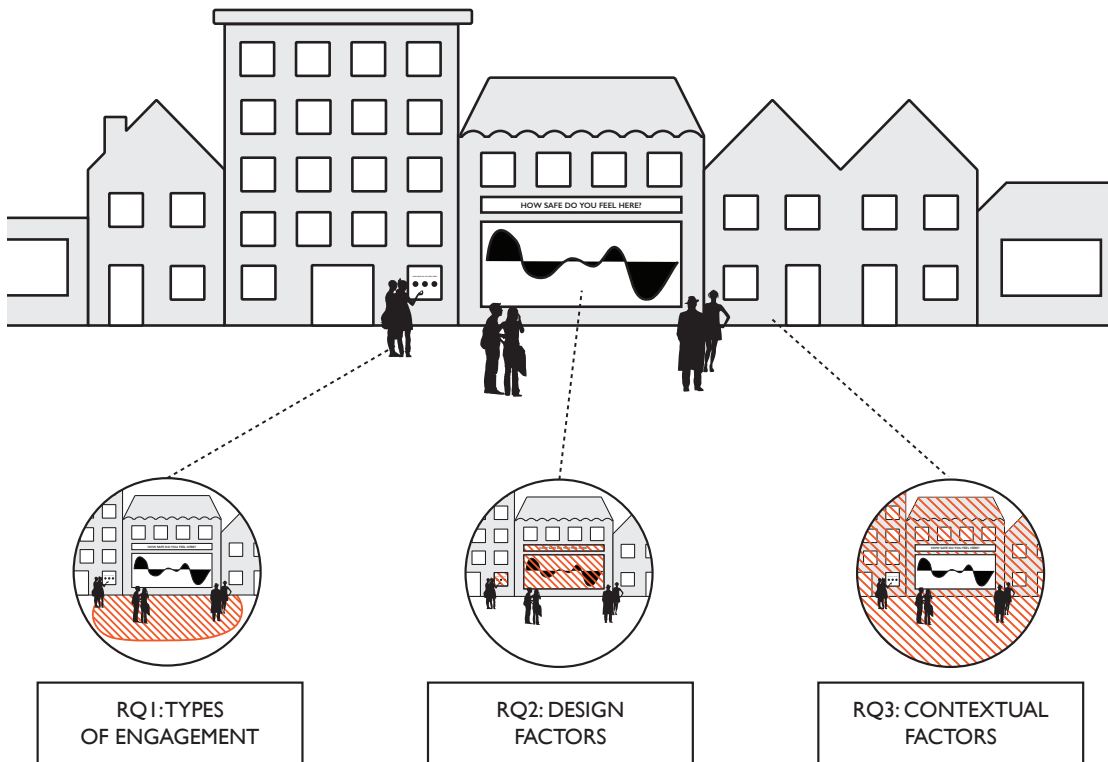
The objective of this thesis is to examine how situated input technology and public visualisations can facilitate participation in public settings, by engaging passers-by with hyperlocal topics. By collecting input and feedback on topics related to the immediate surroundings, the aim of such ‘urban visualisation’ interventions is to encourage people to take part and become involved in local discourse. By also publicly displaying the collected data, people are enabled to find out more about the perceptions held by others in the area, such as their beliefs, opinions, values, suggestions, and concerns. These public visualisations are designed to further engage people in local discourse.

Traditional ways of involving and consulting the public, for example through voting and surveys, are typically one-sided processes where one party collects opinions from a range of people, often for the purpose of decision-making or the evaluation of an event. However, technology makes it possible to make this process more interactive and two-sided, by opening up and sharing the gathered data publicly. Currently, only a portion of consultations provide people with the option to view the findings – often in the shape of an online report that is published at the end of the project. However, this publication of results is often far removed from the people who originally participated. What if we change this, and enable those who participate to also be able to immediately learn more about the perceptions of others? How can this more transparent process motivate people to consider and discuss locally-held views?

Previous work has shown how public screens with games, photos or other types of entertainment can successfully evoke interest, inform people and spark discourse in public settings — but till date little is known about how urban visualisation interventions can engage people. While data visualisations in the form of infographics have become increasingly prominent in newspapers, mobile applications and dashboards, few studies have investigated the outdoor, public presentation of data. As visual representations of data are created to make the data more accessible and easy to understand, the concept of public visualisations has the potential to engage a wide variety of people — including those unfamiliar with modern technology. By displaying data on local perceptions, that people can personally relate to, in such an accessible manner, public visualisations have the potential to not only inform people, but to also act as a talking point for people to interpret, share and discuss local perceptions. Furthermore, visualisations of this local data can reveal new information to the people living, working, or moving through the area, for example about topics that are not often publicly discussed.

Through a series of in-the-wild studies, this thesis examines the types of engagement urban visualisation interventions can evoke. In addition, it investigates the influence of the design of the intervention and the context in which the intervention is placed on this engagement, in order to answer a range of questions: how can we effectively design urban visualisations? What types of input technology can encourage engagement? What types of output foster

situated discourse? And where can we best situate the input technology and public visualisations?



**Figure 1.1:** Visual depiction of the three research questions

## 1.1 Research questions

The work described in this thesis is guided by the following overarching research question:

**How can situated urban visualisation interventions facilitate engagement with local topics?**

*‘Urban visualisation’* is defined as the public collection and visualisation of hyperlocal data in cities. In addition, *‘engagement’* is defined as the experience of being actively involved, as evidenced by behaviours such as observing, participating, and discussing. Using the classification by Carr (1992, p. 118), which describes types of engagement in the public space, this thesis will study passive engagement (e.g. watching others, looking at the intervention, etc.) as well as active engagement (e.g. talking to others, interacting with the intervention, etc.). The term *‘local topics’* refers to themes or questions that are highly specific to the context in which they are addressed, relating to the immediate surroundings.

As the overarching research question is highly exploratory, the following three research questions aim to examine specific elements of urban visualisation interventions. These elements include the types of engagement the interventions can evoke, the design of the interventions, and the context in which they are conducted – as depicted in Figure 1.1.

**RQ1: What types of engagement do urban visualisation interventions evoke?**

Extensive work has been conducted on studying engagement with digital displays in a range of settings, including the urban environment. These studies have revealed a variety of passive and active engagement behaviours, from reading (Memarovic et al., 2012b; Tang et al., 2008) to submitting content (Alt et al., 2011a; Churchill et al., 2004), physically moving (Akpan et al., 2013; Tomitsch et al., 2014), and collaborating (O’Hara et al., 2008; Peltonen et al., 2008). In comparison, little is known about the types of engagement that publicly situated input technology and visualisations can evoke. Building on the findings of the few previous urban visualisation research projects (e.g. Behrens et al. (2014); Taylor et al. (2012); Valkanova et al. (2013)), this thesis aims to map the process of engagement and the specific engagement behaviours in detail.

**RQ2: What design factors affect engagement with urban visualisation interventions?**

While previous public display studies have investigated how different design factors affect engagement, including the size of the display, selected content, and interaction techniques (e.g. Müller et al. (2009); O’Hara (2003)), there is a lack of work that looks into the role of the design of urban visualisation interventions on engagement. Therefore, RQ2 investigates these factors, specifically the factors relating to the three key elements of urban visualisations: the addressed topic, the input technology, and the output.

**RQ3: What contextual factors affect engagement with urban visualisation interventions?**

The impact of the context in which the urban visualisation intervention is deployed on engagement is also examined. Specifically, this final research question examines the role of the



location, community, and other contextual factors that affect engagement with the intervention. These contextual factors are typically difficult, if not impossible to control, but in studies of situated displays and projections in the public space they have been found to influence engagement (e.g. Akpan et al. (2013); Fischer and Hornecker (2012)).

In addition to addressing these research questions, the individual case studies described in this thesis examine different settings and technologies. More specifically, the studies cover a diversity of data topics, input technologies, and output designs, in order to investigate how these elements affect engagement (for more information see Figure 1.2). All designs were informed by the findings from the previous case studies, as well as the specific setting in which the deployment would take place. For example, in Chapter 4 the use of simple voting devices as input technology is studied, with a specific focus on the distribution of such technology – and the effect such distribution has on engagement. To highlight the specific focus of each case study, at the start of each case study chapter an additional set of in-depth research questions is outlined.

CASE STUDY	TOPIC	INPUT	OUTPUT
I: VISUALISING MILL ROAD	COMMUNITY-GENERATED	VOTING (D)	DELAYED UPDATES (D)
II: FAIR NUMBERS	ENVIRONMENTAL	VOTING (D)	REGULAR UPDATES (C)
III: VOXBOX	EVENT FEEDBACK	MIXED (C)	REAL-TIME UPDATES (C)
IV: VOXBOX REAPPROPRIATED	PERSONAL	MIXED (C)	TAKEAWAY (C)
V: SCRIBBLES, MAGNETS, TYPEWRITER	OPEN-ENDED	TEXTUAL (D)	INTERACTIVE (C)
VI: URBAN TYPEWRITER	CONSULTATION	TEXTUAL (N)	DELAYED UPDATES (N)

**Figure 1.2:** Research focus of the individual case studies (D = distributed, C = central, N = nomadic)

## 1.2 Contributions

The work described in this thesis contributes to the overall field of HCI, and in particular the areas of urban computing, community technology, and public visualisations, in the following two ways:

1. This thesis provides new understanding of urban visualisations through empirical studies. This empirical work consists of the design, deployment, and evaluation of five input technologies and public visualisations through six in-the-wild studies.

2. This thesis presents frameworks to support designers who are creating and deploying urban visualisation interventions. Specifically, these frameworks map types of engagement, and the design and contextual factors that affect this engagement.

The main contribution of this thesis is the development of a better understanding of the design of urban visualisations, as opposed to the development of urban informatics theory. This design focus is informed by the gaps in existing research. While previous public visualisation work has explored different ways of collecting and displaying a range of data, addressing a variety of topics, it has not provided frameworks, taxonomies, design guidelines, or other outputs that can support the process of creating and deploying public installations. This thesis aims to provide a more systematic way of approaching the design of urban visualisation projects.

The knowledge acquired in this thesis is aimed at researchers and practitioners working within the areas of HCI, urban computing, and public visualisation. This includes, but is not limited to, HCI researchers studying urban installations or situated feedback technology, data visualisation researchers investigating public visualisations, and practitioners at urban design studios.

### 1.3 Thesis structure

This thesis consists of 11 chapters, as visually depicted in Figure 1.3. These chapters are structured as follows:

*Chapter 2* describes a literature review of relevant previous research. This includes an overview of situated technology in the public space, and a detailed description of existing urban visualisation projects.

*Chapter 3* describes the research methodology adopted for the studies covered in this thesis: an in-the-wild research approach. This chapter outlines the motivation behind using this methodology and conducting a series of case studies. Furthermore, it explains how and why the different settings were selected, the approach to designing and developing prototypes, and the process of data collection and analysis.

Chapters 4 - 8 describe the six in-the-wild empirical studies that were conducted. These studies are presented in chronological order.

*Chapter 4* covers Visualising Mill Road, a case study conducted in a neighbourhood setting in Cambridge (UK). The objective of this study was to examine engagement with simple voting devices and regularly updated public visualisations that were distributed along a high street, with the aim of encouraging people to have their say about local topics.

*Chapter 5* describes a second case study, Fair Numbers, conducted along the same street in Cambridge, during a one-day annual fair. Building on the findings from the Visualising Mill Road study, this study was designed to examine engagement with voting technology and a large public visualisation amongst visitors of an event.

*Chapter 6* describes VoxBox, an installation built to consult visitors of events on their experience of the event, and designed to publicly display the collected data. Building on the findings from the Fair Numbers study, the VoxBox was deployed at two sports-related events to examine engagement with a playful, dedicated input and output device.

*Chapter 7* describes how the VoxBox was reappropriated for a deployment at a science fair, where it was used to consult and advice people on their preferences around science careers in a playful manner. Building on the findings from the previous VoxBox deployments, this study aimed to investigate engagement with more personal topics.

*Chapter 8* describes the deployment of Scribbles, Magnets, and Typewriter, three installations designed to collect and display feedback from people who had recently moved office building. The objective of this study was to examine engagement with different input methods and public displays of collected data, to inform the design of a qualitative consultation installation for a neighbourhood setting.

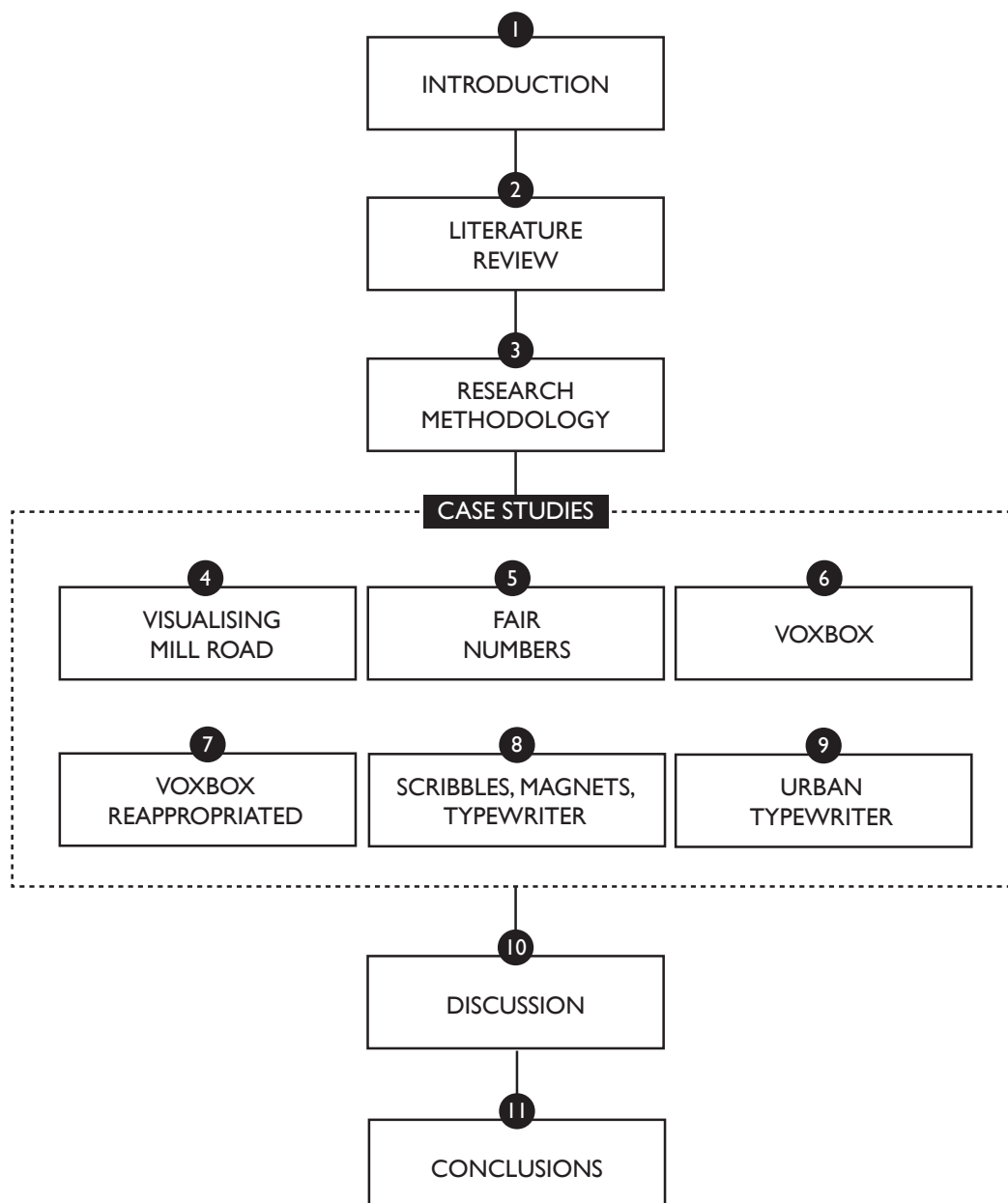
*Chapter 9* describes the Urban Typewriter study, in which a situated input and output installation was deployed at different locations in a neighbourhood setting to consult people on the future of a local park. The deployment was conducted as part of a consultation carried out by the local council. The objective of this study was to investigate engagement with situated technology designed to collect and display qualitative feedback.

*Chapter 10* contains a discussion of the work presented in the thesis and relates this back to the main research questions. This chapter outlines how all types of engagement identified in the various case studies fall into four broad stages of engagement: discovery, understanding, interaction, and sharing. In addition, a framework is presented that maps how factors relat-

ing to the design and context were found to affect these stages of engagement. A use case is provided to demonstrate how the frameworks can be used to support the design process. Furthermore, in the discussion directions for future research in the area of situated input and output technology are outlined.

*Chapter 11* summarises the main conclusions of this work.

Two additional formative studies are presented in the Appendices A.1 and A.2.



**Figure 1.3:** Thesis outline

## Chapter 2

### Literature Review

The goal of this thesis is to examine how we can effectively design urban visualisation interventions that can facilitate participation in public settings. To do this, a series of in-the-wild studies have been conducted to identify the types of engagement such interventions can evoke, and to investigate the role of the installation's design and the role of the context in which it is placed on this engagement. In addition, in the following sections literature from three areas of research is reviewed to provide a background for this work: urban developments, community technology, and public visualisations.

The literature review is structured as follows: firstly, a brief introduction is provided on work in the area of urban developments, discussing the concept of community cohesion, loss of community, and community participation (Section 2.1). This introduction explains the context in which this research is undertaken, and the motivation behind supporting community participation. Secondly, an overview is provided of existing research in the area of community technology (Section 2.2). This includes a brief overview of recent work in the domain of urban informatics, and highlights related community technology studies designed to engage people in urban communities. Thirdly, existing work in the area of public visualisations is discussed – ranging from art projects to in-the-wild research studies (Section 2.3). Furthermore, it outlines the types of mediums that have been used till date, including public displays and media projections. The literature review concludes with a discussion of the research gaps in existing literature, and outlines how this thesis aims to address these gaps.

## 2.1 Urban developments

### 2.1.1 Urban communities

Over a period of several millennia, the concept of urbanisation has developed significantly. What started out as small, primitive settlements – first created after the Neolithic Revolution when agriculture allowed people to live non-nomadic lifestyles – has evolved into large, dense and complex settlements often containing hundreds of thousands if not millions of people. The term ‘city’ is used to describe this change. Jacobs (1961, p. 30) describes one of the main differences between such large cities and smaller towns and suburbs as follows:

*“Great Cities are not like towns only larger; they are not like suburbs only denser. They differ from towns and suburbs in basic ways, and one of these is that cities are by definition full of strangers. To any one person, strangers are far more common in big cities than acquaintances.”*

The population-density and compactness of cities offers many economic and environmental benefits, such as resource efficiency and a relatively low ecological impact (Newman, 2006). However, this population-density also creates an environment in which the majority of people are strangers to one another. This has resulted in the development of urban communities, defined by de Waal (2014) as: *“The more or less voluntary assembly of citizens who share single (or perhaps plural but seldom all) aspects of life”*. Those with similar religious or political beliefs, or those who share a geographical location — such as all people living in one neighbourhood, may, for example, form a community. Individuals can be members of several such communities at the same time.

The focus of this thesis will be specifically on permanent and temporary geographical urban communities (communities of place), consisting of people who live, work or otherwise spend time in the same area of a city. These geographical areas make up only a small part of the city, in which ‘community members’ regularly spend time. Especially permanent geographical communities allow for more social interaction: community members are likely to encounter one another at least occasionally, which enables people to become acquaintances or ‘familiar strangers’. The latter concerns *“individuals that we regularly observe but do not interact with”* (Paulos and Goodman, 2004).

In addition, members of urban communities often have overlapping interests about their shared geographical area. For example, people living along one street are likely to all be affected by roadworks, changes in shop opening times and new safety measures in the neighbourhood. To share information on such common interests, or to gather people for activities or civic action at, for example, public consultations, informal events are often organised. Specific causes or interests can also motivate the forming of community groups and the organisation of community activities. All these different types of get-togethers further encourage social interaction within the geographically bounded area, which can foster a sense of community; a feeling of belonging to the urban community (Prezza et al., 2001). Sarason (1974) has defined this psychological sense of community as follows:

*“The perception of similarity to others, an acknowledged interdependence with others, a willingness to maintain this interdependence by giving to or doing for others what one expects from them, and the feeling that one is part of a larger dependable and stable structure”*  
(Sarason, 1974, p. 157)

Having such a sense of community is shown to be beneficial for individuals as well as the community and city as a whole. It has been found to relate to subjective well-being (Davidson and Cotter, 1991; Pretty et al., 1996; Prezza et al., 2001), a reduction of stress levels (Cacioppo and Hawkey, 2003; Kawachi and Berkman, 2001), as well as empowerment (Chavis and Wandersman, 1990; Speer, 2000). A sense of community, for example, negatively correlates with loneliness (Pretty et al., 1996; Prezza et al., 2001) and positively with life satisfaction (Prezza et al., 2001). Furthermore, social connectedness within geographical areas, often referred to as ‘social capital’, is believed to have many advantages to society on the whole, as it, for example, facilitates civic participation (Putnam, 1995a) and resilience (Norris et al., 2008). Such participation is key to the functioning of geographical communities, and ultimately democracy, as it ensures that local views are heard and discussed — and potentially taken into account during decision making processes. Active participation in the organisation of the community has also been found to increase feelings of competence and control (as described by Florin and Wandersman (1990)).

However, despite these benefits, different researchers have raised concerns about the level of social connectedness in modern cities (e.g. Putnam (1995a)). They claim that different factors, such as migration and mobility (Dijst, 2014), have caused increased individualisation

and decreased loyalty and attachment to traditions, communities, family, and religion. The next section explores this loss of community, and the effects it is believed to have on individuals and societies.

### 2.1.2 Loss of community

A number of sociologists and political scientists (including Bellah et al. (1985); Keyes (1973); Putnam (1995b)) argue there has been a 'loss of community' in the last decades, particularly in Western societies such as the United States (Nasar and Julian, 1995). They identify a number of reasons for this decline in social cohesion within urban communities, including mobility, privacy, and new technology. Mobility is seen as a reason, as migration is believed to demotivate social interaction: "*why get involved with people where you are, when you know you'll soon be leaving them?*" (Keyes, 1973, p. 17). In addition, there is an ongoing debate about the role of ethnic diversity on social cohesion, and whether achieving a 'sense of community' is more difficult in the heterogeneous societies that form as a result of migration (e.g. (Cheong et al., 2007; Letki, 2008)). Privacy is seen as another factor having affected community life, as Western societies greatly value isolation. The built environment has been adjusted to this need for privacy. Houses are designed to be self-sufficient units; they are designed to ensure a high level of privacy for the residents by keeping others out. Building for self-protection in this manner eventually makes people "*lose the ability to let others inside their secluded world*" (Keyes, 1973, p. 18). Finally, new technology is believed to have decreased social cohesion. Keyes (1973), Turkle (2012), and Putnam (1995a) argue the car has played an important role in this process, by providing people with mobility and outdoor privacy. The TV is identified as (chronologically) the next threat to social cohesion, as it has motivated people stay indoors more, within their self-sufficient units (Putnam, 1995a). While Norris (1996) finds further evidence for this claim, she argues that watching news and current affair programs, which many people do, may have positive effects on society as a whole, too.

Other modern technological advancements, such as the Internet and the mobile phone are believed to have further affected social connectedness. As they enable mediated communication, they facilitate social behaviour. As noted by Calhoun (1998), the Internet supports the forming of communities — especially communities of people with similar interests. Typically, these communities comprise people from a wide variety of geographical locations. This has sparked an extensive debate on the effect of this technology on face-to-face com-



munication and traditional geographical urban communities, with some claiming there has been a negative effect (e.g. Kraut et al. (1998)) while others strongly oppose this (e.g. Jennings and Zeitner (2003)).

In addition to increasing loneliness, it is argued the decline of social cohesion has several effects on broader society. For example, Putnam (1995a) discusses how a decrease in social participation affects democracy, as it decreases societal debate. Coleman (1988) argues that the establishment of norms is an important aspect of social cohesion. Effective norms allow people to feel safe in their community, as 'good' behaviour is encouraged and rewarded by the community, while 'bad' behaviour is discouraged. When such norms exist people also know they can count on the support of their community whenever people do not comply with the norms. Decline in social cohesion can therefore decrease safety in urban communities.

The claims about declined and declining social connectedness have generated much debate, with reactions ranging from strong opposition to agreement. These different arguments have been extensively discussed by Stolle and Hooghe (2005), who conclude more research is needed in order to draw conclusions about systematic and sustained changes over time in social connectedness in urban communities. However, whether there is a systematic decline in social cohesion, or if the decline is only natural, after the highly social 1950s and 1960s, as proposed by Stolle and Hooghe (2005), there appears to be some agreement amongst researchers: modern Western urban communities are less socially connected in the traditional sense. While modern technologies provide people with the opportunity to be constantly in touch with others, urban communities (i.e. communities of place) have suffered from a decline in face-to-face communication over the last decades.

There have been a number of projects that have tried to bridge this gap, and have started exploring how technology may facilitate the kinds of social interactions that are believed to have decreased. They have done this through the use of new public facing technologies, such as displays, kiosks, and other types of situated installations. In the next section, a brief history will be given of these projects aimed at connecting people through so-called community technologies.

## 2.2 Situated technology

Before the invention of the printing press and telephone, news and other announcements were primarily spread via spoken word — as most people were illiterate. Announcements about, for example, marriages, births and deaths were disseminated via one-to-many communication, by town criers (Lofland, 1989). These town criers would stand in a popular and accessible place, such as a public square, and convey these messages to the assembled audience. Similar one-to-many communication techniques were adopted in places around the world, like the use of talking drums in many countries in Africa (Mushengyezi, 2003). Print journalism largely replaced oral news, with the introduction of one-page pamphlets (Streckfuss, 1998). Pamphlets could be bought locally every few weeks. Content was sometimes sensationalised, to increase sales (Streckfuss, 1998, p. 89). Pamphlets were also used for propaganda purposes, such as spreading religious and political beliefs (Sawyer, 1990). In the 17th century pamphlets were replaced by a new communication medium: the newspaper.

Throughout history, different communication tools have also been physically placed in the built environment, such as signage and noticeboards. The latter have allowed residents to actively participate in disseminating information and announcements. In recent years, these noticeboards have been studied extensively — primarily to inform the design of alternative local communication media (e.g. Alt et al. (2011b); Churchill et al. (2003); Fortin et al. (2014c); Taylor and Cheverst (2008)). This work is part of a larger movement exploring how technology can support people living in cities, conducted under the banner of ‘community technology’. Erete (2013) presents a theoretical framework to support the design of such community technology. This framework assesses technologies by their ability to successfully engage communities, groups, and individuals. Furthermore, based on an analysis of past projects, Erete outlines three best practices for community technology, arguing they should a) increase social cohesion and social capital, b) engage small groups of community members, and c) encourage participation through interest-based technologies. Examples of technologies that aim to engage communities in such a manner include hyperlocal news websites (Baines, 2012) and hyperlocal social networks (e.g. Nextdoor (2011); Streetlife (2011)), which allow members of communities to stay up to date and connected with other members.

In addition to online tools, the use of situated technology, placed directly into urban communities, has also become a focus of community technology research. This work has partly

been motivated by the aim to democratise ubiquitous technology (e.g. Vlachokyriakos et al. (2014); Weise et al. (2012)). Situated interventions have typically focused on the use of computing technology to foster local engagement in specific neighbourhoods, streets, or places. Such engagement can range from people noticing the intervention, to talking about it with others, and directly participating by, for example, using the technology to cast a vote. Carr (1992) differentiates between two types of engagement with elements in the public space: passive engagement and active engagement. While the former refers primarily to the act of observing (e.g. watching others), the latter describes “*a more direct experience with a place and the people within it*” (Carr, 1992, p. 118). This includes, for example, interacting with people (e.g. talking to strangers) and interacting with physical elements of the environment (e.g. playing with fountains). Fostering engagement in public settings is often difficult, as there are generally various other elements in the environment that attempt to attract people’s attention, such as traffic signs, advertisements, and traffic.

Many situated technology projects make use of situated devices in order to foster such active engagement, often with the aim of encouraging social interactions (e.g. Fatah gen Schieck et al. (2008)). One of the approaches that has been explored is to use such technology to encourage and facilitate face-to-face interactions by connecting strangers and ‘familiar strangers’, i.e. individuals we regularly observe but do not interact with (Paulos and Goodman, 2004). To achieve this, both digitalised traditional tools, such as digital community noticeboards (Churchill et al., 2003; Redhead and Brereton, 2009), as well as a range of novel technologies have been developed and evaluated. Paulos and Goodman (2004), for example, developed the ‘Jabberwocky’ device and mobile application to capture and visualise familiar strangers by collecting Bluetooth addresses of nearby devices. By using technology to shed light on such informal social relationships within spaces, the researchers aimed to promote social connections. Similarly, Dunne and Raby (1995) created benches to provide people with awareness of others currently present in the vicinity. By integrating sensors in the benches, moments when two ‘partner benches’ were occupied could be detected. To make the people on both benches aware of this connection, Dunne and Raby decided to communicate their presence in a novel manner, by heating up the seats — a sensation “*potentially as uncomfortable as sitting on a recently vacated seat*” (Gaver, 2002, p. 475). A situated intervention aimed at connecting people was also used by Balestrini et al. (2016), who deployed an installation consisting of two boxes with large pushbuttons at the top, which were placed a

few meters apart from one another. To interact with the installation, people were required to coordinate their behaviour, and press the buttons simultaneously. This coordination, in turn, was found to often lead to further conversation and laughter between strangers. These studies of novel social technologies show that there is potential for technology to act as an ice breaker in evoking interactions between strangers in public spaces.

### 2.2.1 Public input devices

Another approach to community technology is the deployment of devices to elicit feedback from people in public settings, notable examples including the Opinionizer (Brignull and Rogers, 2003) and TexTales (Ananny and Strohecker, 2009). These initial deployments made use of standard off-the-shelf input technology, like a keyboard, which enabled people who were familiar with these types of input mechanisms to easily engage with the technology. The use of pushbuttons for the voting devices deployed by Taylor et al. (2012), for example, demonstrates that the use of a simple and familiar input mechanism can be key in encouraging interactions. Taylor et al.'s findings show that the low complexity of the devices lowered barriers to participation, and that other input mechanisms with higher complexity – such as the use of a mobile phone to cast a vote – received far fewer interactions.

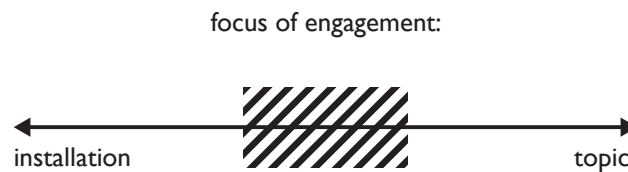
Other studies have looked into the development of bespoke installations, designed around familiar input mechanisms, to make the technology more attractive to use. For example, Fischer et al. (2013) developed an installation that enabled people to 'shoot' messages onto a wall projection using a digital slingshot. The aim behind this project was to create "*a digital speaker's corner*", inspired by ancient Greek agorae. Findings from multiple deployments show that people successfully interacted with the slingshots, and that the devices facilitated and evoked social interactions, such as discussions around what messages to type and the synchronisation of shooting – with multiple people slinging their submissions simultaneously. Similarly, Fortin et al. (2014b) also aimed to develop a digital speaker's corner, by allowing people to talk into a digital megaphone. Speech recognition was applied to all contributions, and a word cloud-like visualisation was projected onto a nearby building. This voice-activated input mechanism enabled over a thousand people to actively participate with the intervention, who engaged with the intervention in a variety of ways, from the sharing of personal poetry (Fortin et al., 2014a) to appropriation by political activists (Fortin and Hennessy, 2015). The use of body movement to cast a vote has also been investigated, including

the use of arm gestures (Valkanova et al., 2014) and foot presses (Steinberger et al., 2014). Findings from both studies reveal that the use of such playful input mechanisms can still evoke serious participation, but that the topic on which people vote is an important factor in this.

All of these studies capitalise on familiar actions that do not have to be learnt, and reintroduce these actions in new contexts, with the intention of making the input technology accessible to a wide range of people. However, the studies also reveal various trade-offs. One of these trade-offs is the balance between public participation and providing a sense of privacy. The findings from Valkanova et al. (2014) and Steinberger et al. (2014), for example, suggest that while whole body interaction interventions may be eye-catching, and provide a highly enjoyable interaction experience, the public nature of this type of interaction reduces privacy. As a result, this type of input technology is less suitable for more personal or controversial topics. Furthermore, O'Hara et al. (2008) found that whole body interaction can evoke evaluation apprehension, where people become hesitant to participate out of fear of being judged by onlookers. In contrast, highly public input mechanisms have also been found to evoke the honeypot effect, where people gather around the technology after seeing others interact with it (e.g. Brignull and Rogers (2003)).

Another trade-off is the balance between the ease of use of input technology and the quality of the collected data. Voting, for example, is a highly accessible way of engaging people in voicing their opinion. However, voting devices can only record low fidelity types of input, such as 'agree' or 'disagree', without being able to capture more in-depth responses – like the reasons behind those votes. In addition to the input limitations, highly accessible and unrestricted input technologies are also more susceptible to appropriation. This ability to appropriate the technology can be both positive and negative. Fortin et al. (2014b) found that people used their digital megaphone in ways they had not previously envisioned. People, for example, reappropriated the installation as a live offline social network, and as a memorial space to pay homage to the victims of police brutality. Such unexpected uses can be valuable in engaging people. However, appropriation can also negatively affect the quality of the collected data. Taylor et al. (2012) and Vlachokyriakos et al. (2014) found that their highly accessible voting device were frequently used by people to cast multiple votes, influencing the results of the polls. On the other hand, when the technology is more con-

strained, for example through the use of a mobile phone (e.g. Schroeter and Foth (2009)) or RFID-enabled cards (e.g. Behrens et al. (2014)), the quality of the data can be improved, by only allowing every person to vote once. However, this more restricted approach can also limit participation as it excludes all people without phones or RFID-enabled cards.



**Figure 2.1:** Effective community technologies strike a balance between engagement with the installation and engagement with the topic the installation addresses

The studies also show, however, that the success of situated input devices is not just dependent on the chosen input mechanism, but also on a range of other factors, such as how noticeable, inviting, and easy-to-use the devices are. The literature, for example, suggests that there is a balance to achieve between the engagement people have with interactive community technology and the engagement people have with the topic the technology addresses (see Figure 2.1). When the technology evokes significantly higher levels of engagement, for example because the interaction is very playful (e.g. Hosio et al. (2012)), this can result in superficial usage during which people pay little or no attention to the topic. Similarly, when the topic is highly engaging, but the input technology is not, the installation may evoke reflection and discussion but no direct participation. Therefore, a balance should be struck between the two, to ensure people engage with both the form factor and the content.

Furthermore, the review of the literature suggests that community-wide participation is a key challenge for the development and deployment of input technology. How can people easily access the technology? And perhaps even more importantly, how will they find out about its existence in the first place? Particularly important for the facilitation of community-wide participation is identifying one or more suitable locations for deployment. Typically, most studies have placed the technology in central locations, providing a single input location (see Table 2.1). While the deployment of technology at one location can prove sufficient, it requires the existence of such a key location. This type of situating works particularly well for locations such as public squares, train stations, and shopping malls, which attract large crowds of people to central areas, but it is less effective for areas such as resi-

Study	Input location(s)	Output location(s)
Ananny and Strohecker (2009)	Web	1
Behrens et al. (2014)	1	1
Braun et al. (2013)	1	1
Brignull and Rogers (2003)	1	1
Fischer et al. (2013)	1	1
Fortin et al. (2014b)	1	1
Gianluca et al. (2013)	1	1
Hosio et al. (2012)	1	1
Kriplean et al. (2012)	1	1
Leong and Brynskov (2009)	1	“Various”
Schroeter (2012)	SMS	1
Simm et al. (2012)	SMS / Web	1
Steinberger et al. (2014)	1	1
Steins et al. (2011)	1	1
Tang et al. (2008)	SMS	1
Taylor et al. (2012)	3	3
Valkanova et al. (2014)	1	1
Vlachokyriakos et al. (2014)	2	Web
Whittle et al. (2010)	1	1

**Table 2.1:** Overview of studies in which opinion gathering technology is situated in public spaces. For each deployment, the number of input (e.g. voting technology) and output (e.g. visualisation of votes) locations is shown.

dential neighbourhoods, which do not have one clear ‘common place’ that is frequented by a large proportion of the local community.

Frequently, public input devices are connected to displays, which are used to show the collected data publicly (see Table 2.1). The deployment of such public displays is investigated in more detail in the next section.

## 2.2.2 Public displays

The display of information in public settings, with the intention of engaging passers-by, makes up the vast majority of community technology studies. Researchers have deployed both single displays as well as multiple networked displays (e.g. Ojala et al. (2010); Storz et al. (2006)). Such displays can be projected onto the existing infrastructure, like building façades, but most often use is made of interactive public screens – which can function both as input and as output technology. Studies till date have explored the deployment of projections and screens with a variety of functionalities, such as taking and browsing photos (e.g. Memarovic et al. (2013); Taylor and Cheverst (2009); Peltonen et al. (2008)), posting and

viewing messages (e.g. Munson et al. (2011); Redhead et al. (2009)), and playing games (e.g. Freeman et al. (2013); Müller et al. (2014); O'Hara et al. (2008)). These application were developed with the aim of evoking social interactions, including collaborative play and discourse. Furthermore, through in-the-wild deployments of such public displays, researchers have examined how the design of displays, and the context in which they are placed, affect engagement.

To learn more about where best to situate public displays, early fieldwork by Churchill et al. (2003) studied the use of traditional bulletin boards. Churchill et al. identified several locations in which bulletin boards are typically placed, including places where people spend time waiting (e.g. train stations, bus stops, waiting rooms, launderettes), places where people socialise (e.g. cafes) or routinely walk (e.g. corridors), and places people visit with the intention of seeking information (e.g. libraries, community centers). Building on these findings, researchers examined the context of displays in more detail, identifying distinct spaces in which people engage with displays in different ways. Brignull and Rogers (2003), for example, distinguish between three 'activity spaces', in which peripheral awareness activities (such as noticing the display but not actively looking at it), focal awareness activities (such as talking about or pointing towards the display), and direct interaction activities (such as touching the display) take place. Similar frameworks of how the physical space and people's proximity to a display affect engagement have been developed by several other researchers. These frameworks identify the zones of engagement around displays (e.g. Fischer and Hornecker (2012); Memarovic et al. (2012b); Streitz et al. (2003)) and people's stages of engagement within the space (e.g. Finke et al. (2008); Michelis and Müller (2011)). In addition, these studies of the context of displays also provide insight into the impact of the social setting on engagement. For example, Brignull and Rogers (2003) found that the gathering of people around a display evoked a *honey-pot effect* – where the presence of people attracted others to the display. Those who approached subsequently observed how people interacted with the screen, or socialised with those around them – with the display acting as an icebreaker. This honey-pot effect was observed again in other studies, including by Hespanhol and Tomitsch (2012), Memarovic et al. (2012b), and Müller et al. (2014). In contrast, the presence of people in the space around the display has also been found to hinder engagement, as it can make people feel awkward about participating. Such *social embarrassment* (Brignull and Rogers, 2003), or *evaluation apprehension*, is described by O'Hara et al. (2008) as "a fear of being judged



for their behaviour by social others in the vicinity witnessing the behaviour”. This fear is particularly prominent when interaction with displays requires expressive physical movements that can be socially awkward in public settings (O’Hara et al., 2008; Wouters et al., 2016).

Furthermore, the in-the-wild evaluations of screens have revealed another major challenge within the domain of public displays: catching the attention of passers-by. In many studies, people have been found to ignore public screens. (Müller et al., 2009) explain that this happens due to so-called *display blindness* – which refers to the expectations held by people passing by a display: if people expect uninteresting content to be shown on a display, such as advertisements, they are likely to ignore it altogether. Huang et al. (2008) found that when people do notice a display, they typically look at it only briefly. Huang et al. also found that the positioning of the display is key in attracting engagement, with displays at eye-level receiving more attention than those located below or above eye-level.

In addition to the role of the deployment location, social setting, and the positioning of displays, a range of other factors have been found to affect engagement. These factors include aspects of the design of the display, such as the topic it addresses (Gianluca et al., 2013) and the size of the display (Dalton et al., 2015; Huang et al., 2008), as well as factors related to the context in which the display is placed, such as the role of other objects in the display’s surroundings (Dalton et al., 2015; Huang et al., 2008) (see Table 2.2).

Design factors	
Display size	Dalton et al. (2015); Huang et al. (2008)
Topic	Gianluca et al. (2013)
Clarity of purpose of display	Munson et al. (2011)
Aesthetics of displayed content	Kukka et al. (2013)
Contextual factors	
Location of display	Gianluca et al. (2013); Behrens et al. (2013)
Positioning of display	Huang et al. (2008); Seeburger and Foth (2012)
Presence of other people	Brignull and Rogers (2003); O’Hara et al. (2008)
Other objects in the surroundings	Dalton et al. (2015); Huang et al. (2008)

**Table 2.2:** Overview of key factors that have been found to influence engagement with public displays

Researchers have formulated design implications aimed at overcoming display blindness and encouraging engagement (e.g. (Alt et al., 2011b; Huang et al., 2008; Memarovic et al., 2012a)). However, while the design of displays can help mitigate some barriers to participa-

tion, the study of displays in-the-wild has also demonstrated that there are contextual factors that researchers are unable to influence (Huang et al., 2007; Vande Moere and Wouters, 2012).

In summary, the effectiveness of different community technologies, such as public input devices and public displays, has differed greatly between studies, and is influenced by a range of factors. These factors relate to the design of the technology as well as the context in which it is placed, and as a result can typically only be partially influenced by researchers. Nevertheless, the literature demonstrates that both the deployment of input devices and the deployment of public displays in urban communities can successfully evoke engagement. In the next section, literature describing the development and deployment of public visualisations will be reviewed – including ambient displays and other types of public representations of data.

## 2.3 Public visualisations

A central part of community technology is attracting passers-by to take notice of the deployed installation. This can be challenging for a number of reasons, including display blindness (Müller et al., 2009) and the number of other elements in the environment that also aim to attract the attention of passers-by – such as road signs, shop signs, and advertisements. In order to communicate other types of information to people in cities, artists and researchers have been investigating how best to design visualisations suitable for public spaces – that are able to successfully attract attention. Using such public visualisations, projects have explored alternative ways of representing information, ranging from the display of currency rates through fountains <sup>1</sup> to street art showing a painted tally of deaths of American soldiers on a wall in Brooklyn (New York, USA), categorised by deaths by suicide versus deaths by combat in Iraq <sup>2</sup>. In the following sections, the study of ambient displays and other, more recently developed types of public visualisations are discussed.

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<sup>1</sup>Data Fountain (2006) by Koert van Mensvoort - <http://www.koert.com/work/datafountain/>, retrieved March 2015

<sup>2</sup>American Kills (2010) - <http://www.meetsebastian.com/sebastian-errazuriz-design-art-american-kills-public-work>, retrieved March 2015

### 2.3.1 Ambient displays

The concept of ambient displays was first discussed in Weiser's 'Designing Calm Technology' (Weiser and Brown, 1996), in which he describes the 'Dangling String' installation by artist Natalie Jeremijenko. This artwork consists of a plastic string hanging from the ceiling, which whirls at varying speeds depending on the amount of data transferred through a nearby Ethernet cable. Weiser describes the combination of the string's ability to be visible and audible, yet unobtrusive, useful and fun, as the ultimate characteristics of calm technology. This notion of conveying information in the periphery was later coined 'ambient display'. Mankoff et al. (2003) define such displays as follows: "*Ambient displays are abstract and aesthetic peripheral displays portraying non-critical information on the periphery of a user's attention*". Crucial is the idea of using the periphery. Instead of requiring full attention, the aim is to inform people without distracting them from their key activity. For this reason, the information communicated via ambient displays should not be of critical importance. The information should, however, be of relevance to the people in the display's surroundings.

Research into ambient displays (also referred to as 'peripheral displays') has seen great popularity in the last 20 years. Studies have covered a wide range of topics, from network usage (Dahley et al., 1998) to posture (Jafarinaimi et al., 2005), and usage of stairs versus lifts in an office setting (Rogers et al., 2010). Apart from a variety of topics, this research has also explored the use of a variety of displays. While digital screens and projections have been used frequently (e.g. (Consolvo et al., 2004; Rodgers and Bartram, 2011; Skog, 2004)), the use of mobile technology (e.g. (Consolvo et al., 2008; Froehlich et al., 2009a)) and custom physical displays (e.g. paper (Jafarinaimi et al., 2005; Antifakos and Schiele, 2003), water (Dahley et al., 1998; Heiner et al., 1999), fibreglass (Ishii et al., 2001; Rogers et al., 2010)) have also been studied extensively.

The two primary aims of these ambient displays have been to convey information with the purpose of creating awareness or encouraging behaviour change – or a combination of both. A large number of studies have, for example, investigated the use of ambient displays to encourage people to reduce their energy and water consumption. These studies have visualised consumption by lighting up power cords (Gustafsson and Gyllenswärd, 2005) and shower heads (Arroyo et al., 2005), displaying temporal patterns via custom clock-like devices (Broms et al., 2011), and presenting people with abstract animated artistic visualisations

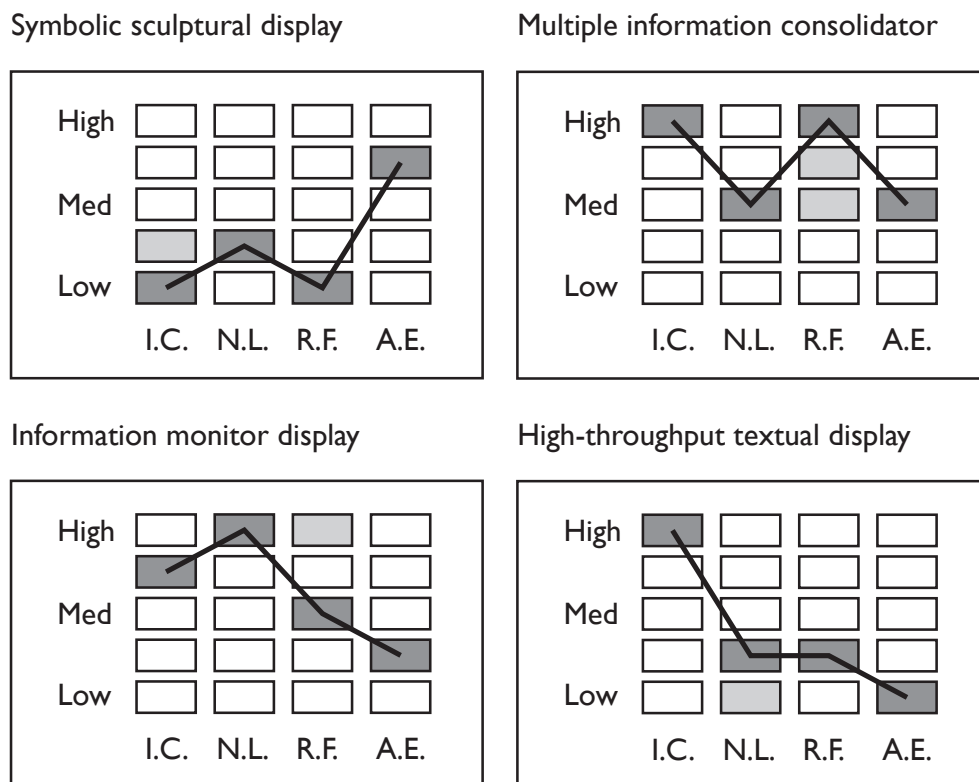
via situated digital screens (Rodgers and Bartram, 2011). Similar approaches have been used for a range of other purposes, including to encourage people to become more physically active (e.g. Burns et al. (2012); Fortmann et al. (2013); Jafarinaiimi et al. (2005)), and to increase people's awareness of what is happening in different physical spaces around them (e.g. Prante et al. (2003); Skog (2004); Wisneski et al. (1998)).

To support the design and evaluation of ambient displays, researchers have examined the factors that make a display effective. For example, Rodgers and Bartram (2011) have specifically looked into the design of ambient displays for eco-feedback. Based on the findings from a deployment of tablets with different ambient visualisations of energy usage and a review of the literature, Rodgers et al. identify four design requirements that such eco-feedback ambient displays must meet to be effective in domestic settings, arguing displays should be *pragmatic* (understandable and appropriate for the activity), *aesthetic* (attractive and coherent with the home setting), *ambient* (in the periphery, requiring an appropriate level of attention), and *ecological* (appropriate size, position, and location). Other researchers have investigated different aspects of eco-feedback technology, such as its interactivity and behaviour change approach (e.g. Froehlich et al. (2010); He et al. (2010); Pierce et al. (2010)), and collectively this body of work outlines several broad design considerations for eco-feedback ambient displays. However, it does not provide designers and researchers with a practical overview of factors to take into account. Therefore, Matthews et al. (2003), developed the 'Peripheral Display Toolkit', aimed at supporting more systematic design of ambient displays. The toolkit is meant to aid the design process by outlining a system architecture that others can adopt. Matthews et al. identify three key characteristics of peripheral displays, namely: *abstraction of data*, *selection of notification levels*, and *transitions between notification levels*. To demonstrate the features of the toolkit, the authors outline how they designed and developed five applications. This work was later extended by Pousman and Stasko (2006), who present four design dimensions of ambient displays:

- Information capacity - "*the number of discrete information sources that a system can represent*"
- Notification level - "*the degree to which system alerts are meant to interrupt a user*" (similar to Matthews et al.'s 'selection of notification levels' and 'transitions between notification levels')

- Representational fidelity - “a system’s display components and how the data from the world is encoded into patterns, pictures, words, or sounds” (similar to Matthews et al.’s ‘abstraction of data’ )
- Aesthetic emphasis - “the relative importance of the aesthetics of the display”

Using these four design dimensions, Pousman and Stasko plot 19 ambient displays, where each dimension has five modes, from ‘high’ to ‘low’. Based on the trends that emerge from plotting the displays along these dimensions they identify four ambient display archetypes, as shown in Figure 2.2.



**Figure 2.2:** Archetypes of ambient displays identified by Pousman and Stasko (2006), mapping the typical levels of information capacity (I.C.), notification level (N.L.), representational fidelity (R.F.), and aesthetic emphasis (A.E.) (remake of image by Pousman and Stasko)

These four archetypes include *symbolic sculptural displays*, which have low information capacity, notification level, and representation fidelity, but relatively high aesthetic emphasis. These displays typically convey limited information, using an abstract medium, and are often highly aesthetically pleasing (e.g. Ambient Orb (Ambient Devices, 2002) and Dangling String (Weiser and Brown, 1996)). *Multiple information consolidators*, on the other hand, con-

vey highly detailed information on multiple topics, often focusing less on the aesthetics and more on the information capacity (e.g. InfoCanvas (Plaue et al., 2004)). *Information monitor displays* also present highly detailed information on multiple topics, but they notify people about changes in the data in a more obvious manner – sometimes even by interrupting people (e.g. Scope (Van Dantzich et al., 2002)). *High-throughput textual displays* also convey detailed information, and are far less focused on aesthetics – often making use of text and simple icons (e.g. Elvin (Fitzpatrick et al., 1999)). In addition to mapping the ambient displays design space, these archetypes are aimed at supporting designers and researchers by providing them with insight on characteristics of different types of ambient displays – enabling them to categorise their interventions and to make informed choices about which design dimensions to emphasise.

Tomitsch et al. (2007) further expanded these design dimensions, with the aim of creating an ambient display taxonomy. They present a larger number of design dimensions, based on the analysis of 19 ambient displays, arguing their taxonomy has more ‘descriptive power’ than the taxonomy by Pousman and Stasko (2006). These 19 displays show some overlap with the 19 displays studied by Pousman et al., but also include a range of newer displays. Tomitsch et al. (2007) defined the following nine design dimensions:

- *Abstraction level* - To what extent the data can be viewed ‘at a glance’. Metric: low, medium, and high.
- *Transition* - How the display can switch between being peripheral and in the background to being in the forefront and attracting the user’s attention. Metric: slow, medium, and fast.
- *Notification level* - Degree to which display attempts to get user’s attention; to what extent the notification interrupts the user from their main task. Metric: ignore, change blind, make aware, interrupt, and demand attention.
- *Temporal gradient* - Whether a historic view of the data is available. Metric: history, and current.
- *Representation* - Type of display. Metric: physical (custom artefact or device), integrated (integrated in existing artefact or device), and 2D (screen technology).

- *Modality* - Type of output. Metric: visual, tactile, olfactory, auditory, and movement.
- *Source* - Origin of displayed data. Metric: local (data and data source are in same environment), distant (data from source elsewhere), and virtual (data from virtual world such as Internet).
- *Location* - Where the display is situated. Metric: private, semi-public, and public.
- *Dynamic of input* - Rate at which data changes. Metric: slow, medium, and fast.

By providing more design dimensions, and defining custom metrics for all dimensions, Tomitsch et al. (2007) managed to map a far richer picture of the design space of ambient displays. Furthermore, the design dimensions are more concrete, and as a result more applicable in the design process. The addition of ‘location’ and ‘source’ acknowledge the important role context and content play — two components left unaddressed in the work of Mankoff et al. (2003) and Pousman and Stasko (2006).

In addition, another important aspect of ambient display design is not covered by the previously described frameworks and taxonomies: the effect of these design dimensions on engagement, such as the social interactions it may facilitate and evoke. Furthermore, while the described frameworks and taxonomies provide a detailed mapping of the design space, they do not address how the impact and effectiveness of ambient displays should be evaluated. Through several in-the-wild deployments, Hazlewood et al. (2011) and Messeter and Molenaar (2012) have investigated this further, concluding that additional studies are needed to compare and contrast both findings and methodologies. They emphasise a key issue with the evaluation of ambient displays: the role of the researcher — and to what extent this role affects engagement with the ambient display.

In the next section, art and research projects focusing on the design and deployment of visualisations in urban settings are discussed. Unlike ambient displays, these public visualisations typically do not aim to stay in the periphery – and instead are designed to actively engage passers-by with data.

### 2.3.2 Other public visualisations

In recent years a number of projects, including by researchers, artists, and community organisations, have examined the use of public visualisations in urban settings. Their overarching

aim is to encourage people in the urban environment to interpret the visualisation data – which is typically data related to that same environment. Furthermore, these projects often aim to evoke social interactions, such as public discourse about the visualised data. An overview of some of the key projects is shown in Table 2.3. Early work primarily consisted of art projects, such as Heijden’s Tree (Heijdens, 2004) and Nuage Vert (Evans et al., 2009). From 2009, an increase in research projects can be noticed — primarily around the topic of energy consumption.

Below, descriptions of the concept, design, evaluation and results (if any) of this previous work will be discussed. Projects will be covered in chronological order. The level of detail of these discussions highly depends on the information available about the urban visualisations; while research projects tend to have extensive reports on the deployments, a number of art projects lack such descriptions.

### 2.3.2.1 Tree

Tree is an art installation by Heijdens (2004). The installation consists of an 8-meter tall white silhouette of a tree, which is projected onto the façade of a building in a city. The tree moves depending on the speed of the wind passing the façade. Furthermore, when a person walks past the installation, a projected leaf falls from the tree. Fallen leaves are displayed on the pavement and street, and when people walk through them they fly around — in the same way real leaves do. The tree is designed to communicate information about how busy a specific part of the street is. It has been deployed around the world, including in the US, Russia, Japan, UK and The Netherlands. Due to the artistic nature of the project, no evaluation appears to be reported of the effect of the public visualisation of the movement of a city’s residents.

Objective: art

Evaluation of impact: none

Types of engagement installation was designed to evoke: unknown

Engagement evoked by installation: unknown



Name	Topic	Representation	Visual mapping
Tree (Heijdens, 2004)	Passers-by	Animated tree projected onto wall with leaves falling onto pavement	Leaves represent people
Nuage Vert (Evans et al., 2009)	Energy consumption	Green cloud projected onto vapour cloud	Size of clouds represents consumption
Climate on the Wall (Dalsgaard and Hal-skov, 2010)	Climate	Words in speech bubbles projected onto wall	Positioning is determined by participants
Neighbourhood Scoreboards (Vande Moere et al., 2011)	Energy consumption	Set of smileys and line graphs drawn on façade	Smileys represent low consumption
Emotional Cities (Bernardin et al., 2008)	Emotion	Colour projected onto buildings	Projected colour represents most popular mood
Tidy Street (Bird and Rogers, 2010)	Energy consumption	Line graph drawn onto street	Fluctuation of line represents street's consumption
Reveal-it! (Valkanova et al., 2013)	Energy consumption	Polar diagram projected onto wall	Size of slices represents consumption
MyPosition (Valkanova et al., 2014)	Opinions	Bar graph-inspired visualisation projected onto façade	Size of bars represents number of votes
Street Infographics (Claes and Vande Moere, 2013)	Demographics	Isotype chart displayed underneath street signs	Colour of icons represents demographics of people
Smart Citizen Sentiment Dashboard (Behrens et al., 2014)	Opinions	Polar diagram projected onto building	Size of slices represents number of votes

**Table 2.3:** Overview of public visualisation projects in urban settings

### 2.3.2.2 Nuage Vert

Nuage Vert (“Green Cloud”) (Evans et al., 2009) was an art project conducted in 2009, where a green laser projected a visual representation of the electricity consumption of Helsinki (Finland) onto the vapour cloud emitted by the city’s power plant. This projection showed the outline of a cloud. Changes in consumption were depicted in real time, by adjusting the cloud’s size and shape. The artists chose to develop a large public installation to create

awareness about energy consumption and to encourage behaviour change. The green cloud grew whenever there was less energy consumption. From the analysis of the archive of all public and private communication regarding the project, conducted by Marres (2013), it emerged that this ambiguity was not appreciated by all who were involved. When the artists wanted to deploy the installation in Paris (France), they were met by resistance. The owner of the incinerator the artists hoped to use noted: “...a laser projection onto the vapour cloud of the incineration plant would risk eliciting misunderstandings, or even worry from members of the public, if they are not fully informed beforehand as to the meaning of this event...” (Marres, 2013, p. 21). The concerns from several organisations involved eventually meant the artists were not able to show Nuage Vert in Paris. The installation was, however, deployed in Helsinki for one week, during a broader energy campaign in which the residents and business of Helsinki were asked to consume less energy. Every night, between 7pm and 8pm, they were asked to unplug their devices and look at Nuage Vert. This campaign resulted in a decrease of energy consumption, as measured from the consumption of around 35,000 residents and 5 large companies. The artists’ conclusion is: “*The results of the unplug event — realised on a tiny budget and with limited resources — shows that making collective information available to a community in a public form can make a difference.*”. Whether the aforementioned ‘misunderstandings’ occurred in Helsinki is not reported.

Objective: art

Evaluation of impact: none, only analysis of archive of communication between artists and third parties

Types of engagement installation was designed to evoke: noticing, understanding, changing behaviour

Engagement evoked by installation: unknown, but it reportedly evoked changes in behaviour — energy consumption decreased

### 2.3.2.3 Climate on the Wall

Dalsgaard and Halskov (2010) created a temporary installation to raise awareness and create discussion around the topic of climate. The installation, dubbed Climate on the Wall, was deployed in Aarhus (Denmark) for four evenings (from 6pm until 11pm), during a climate conference. The city’s council initiated the project, with the aim of connecting the local

residents to the large, internationally well-known conference. The researchers used this opportunity to allow the locals to express their views via this installations — and thereby actively engage with the conference.

Climate on the Wall consisted of projected words on 30 meters of wall of the council building. These automatically generated words all related to the climate change debate. Passers-by were then able to form short sentences with these words by walking past the wall. All movements were mapped using four webcams placed along the wall, and then projected onto the wall using two projectors. This type of full body interaction was chosen to make the installation accessible to all, without the need for extra devices. Multiple people were able to interact with the installation at the same time. The concept for Climate on the Wall was inspired by the commonly used refrigerator magnets (magnetic poetry), that also allow people to create sentences using a random set of words.

To evaluate the engagement with the installation, Ryan Bengtsson (2012) spent time observing passers-by. While several passing cars and pedestrians in a nearby park stopped to have a look, it was noted that few passed the busy road along the wall to interact with the installation personally. From interviews with a focus groups it emerged that it took many people time to understand the full body interaction. Even those informed about the workings of the installation beforehand had difficulty interacting with the words. As selecting a word required standing still for a period of time and carefully moving it, people expressed finding the process frustrating and slow. The difficult navigation of words, combined with the types of words projected led people to giving up on forming sentences related to climate change. This was primarily because they believed others would not realise it was addressing the climate topic. Instead, they created short sentences and statements on other topics, as they believed these would be more meaningful to others. Whether passers-by were indeed able to interpret these sentences is not reported. However, while the sentences were no longer climate-related, the people interacting with the wall were observed having climate-related discussions.

Objective: research

Evaluation of impact: observations and interviews

Types of engagement installation was designed to evoke: noticing, understanding, par-

ticipating, discussing

Engagement evoked by installation: noticing, understanding, some participating, discussing

#### 2.3.2.4 Neighbourhood Scoreboards

Similar to the Nuage Vert project, Vande Moere et al. (2011) developed persuasive visualisations to encourage inhabitants of a neighbourhood in Sydney (Australia) to reduce their energy consumption. They created private real-time displays as well as public feedback. Chalkboards were attached to the house façade, showing information on the energy usage of the respective household. The boards were manually updated by the researchers every day.

The design of the ‘neighbourhood scoreboards’ was informed by eight design constraints around the development of feedback displays that encourage sustainable behaviour change. These constraints include the *sustainability* of the display itself, that it should be *affordable* and *robust*, respectful to *privacy*, the feedback *intuitive*, *updatable*, *aesthetic* and *persuasive* (Vande Moere et al., 2011). Via an iterative design approach, chalkboards were eventually chosen as medium, as they are typically cheap, weather-resistant and recyclable. All visual information was drawn on the boards by hand, including smileys, the daily ranking (competition between households) and a line graph (historical data of usage).

The study compared three conditions: private and public displays, only private displays and no visible displays. Interviews revealed that participants were already fairly active in thinking about their own impact on the environment. The private displays were perceived as “*more influential*” than the public display, though the latter did generate a great feeling of competition between households. Vande Moere et al. conclude this approach can successfully encourage behaviour change. They conclude that though the visualisations were appreciated for their playfulness, a more participatory design approach might have led to a more appropriate design. The ranking based on percentage of reduction, instead of ranking based on overall usage, was, for example, perceived as counter-intuitive — though the overall visualisation was appreciated for its design and playfulness.

Objective: research

Evaluation of impact: observations, interviews, energy consumption measurements

Types of engagement installation was designed to evoke: noticing, understanding, changing behaviour

Types of engagement evoked by installation: noticing, understanding, changing behaviour

### 2.3.2.5 Emotional Cities

Emotional Cities (Krikortz, 2008) combined online data gathering with a situated visualisation. Artist Erik Krikortz created an online form via which residents of Stockholm (Sweden) could answer the question “How are you feeling today?”. Visitors of the website were able to choose between different seven colours to indicate their mood, where purple depicted the most negative feeling and red the most positive. While people from all over the world could submit their current mood, only answers from people within Stockholm were used to create a public, situated visualisation. These answers were aggregated, and the median emotion of the last hour was visualised using a light installation on five tall buildings in the city (Bernardin et al., 2008). The installation was deployed for several months. After the initial deployment, the art project travelled to a range of other cities, including Seoul. Ryan Bengtsson (2012) describes some of the design considerations made by Krikortz: the installation was meant to a) create interest and spark discussion and b) reach a large audience. Participation was key to the success of the installation, as the light installation depended on mood entries on the website. With the intention of reaching a large audience, Krikortz made use of an online form as the input method. Tall, highly visible buildings with pre-installed lights were chosen, as these could be viewed by a large number of people.

Ryan Bengtsson (2012) also conducted several interviews to establish how people came across and engaged with Emotional Cities. From these interviews it emerged that the buildings were indeed visible from different parts of the city, and that people enjoyed seeing the colourful visual representations. One aspect that was particularly appreciated is the slow pace of the display’s updates, with one participant noting *“Everything is all about turning as quickly as possible, advertisements spinning and changing. And then you are presented with something that breaks from this everyday stress and that is not easily done. But here it was still or slow, and I think*

*this effect made it so unusual.*” (Ryan Bengtsson, 2012, p. 134). People were also found to frequently submit their moods, and several participants mentioned that they enjoyed being able to view the moods across different cities. It also emerged several people made attempts at coming up with explanations of why certain moods were dominant in different cities at different times (e.g. “*they have lost a soccer game*”; “*bad weather*”). No data is reported on the number of mood entries during the deployment in Stockholm, or how residents of the city were informed about the meaning of the different colours and the existence of the website.

Objective: art

Evaluation of impact: interviews

Types of engagement installation was designed to evoke: noticing, understanding, participating

Types of engagement evoked by installation: noticing, understanding, participating

### 2.3.2.6 Tidy Street

The Tidy Street Project (Bird and Rogers, 2010) visualised the energy consumption of a street in Brighton (United Kingdom) on the street itself. All households were able to enter their energy usage online, and the average of the collected data was then painted on the street using chalk spray. In addition, the average usage of the city of Brighton was added to the visualisation, to allow people to compare consumption.

The design of the public visualisation consisted of a line graph filling up the whole length and width of the street, showing the average energy usage in Brighton as well as the average energy usage of Tidy Street. The project lasted for three weeks, and during this period the average electricity usage was reduced by 15%. In addition, observations and interviews along the street revealed that the project encouraged people to consider their energy consumption, and encouraged them to discuss the project with neighbours and passers-by.

Objective: research

Evaluation of impact: observations, interviews, and energy consumption measurements

Types of engagement installation was designed to evoke: noticing, understanding, changing behaviour, discussing

Types of engagement evoked by installation: noticing, understanding, changing behaviour, discussing

### 2.3.2.7 Reveal-it!

Valkanova et al. (2013) created Reveal-it!, “a public, interactive projection that facilitates the comparison of the energy consumptions of individuals and communities”. The visualisation was projected on walls in three different locations. Informed by seven focus group sessions, initial visualisation sketches were developed. From the focus groups it emerged people were mostly interested in how their energy consumption compared to that of others. An additional 3-week workshop with data visualisation experts ultimately resulted in a Florence Nightingale-like rose chart. People were able to submit their energy consumption data via an online form. This data was then aggregated per area and presented in the visualisation in real time.

The visualisation was evaluated in three different locations, using data logs, observations, questionnaires and interviews. Similar to the Tidy Street study, Valkanova et al. conclude Reveal-it was successful in raising awareness and evoking discussion. They do, however, highlight the difficulties around visualising aggregated data, as it may result in decreased trust in the data – which can result in people entering false data.

Objective: research

Evaluation of impact: observations, questionnaires, interviews, and data logs

Types of engagement installation was designed to evoke: noticing, understanding, participating, discussing

Types of engagement evoked by installation: noticing, understanding, participating, discussing

### 2.3.2.8 MyPosition

Similar to Climate on the Wall, MyPosition was an installation that enabled people to interact with projected content using full body interaction. MyPosition allowed people to vote on local topics (Valkanova et al., 2014). The installation was aimed at allowing people to

express their opinions as well as raising awareness of people's opinions and sparking debate. During the design phase, the researchers had several goals. These goals included creating low barrier entry for participation, encouraging participation by making the visualisation engaging, playful, and encouraging spontaneous conversation.

The MyPosition projection was 5 meters wide and 2 meters high and two Kinects were used to capture the movement of people standing in front of the installation. By standing in front of one of four options (range: strongly disagree, disagree, agree, strongly agree) people were able to select their preferred option, while raising one hand would cast the vote. This would then be shown in the visualisation on a coloured tile, added to the existing tiles. Three different tiles were explored, from anonymous to identifiable: plain coloured tiles, tiles containing an image of the contour of the voter, and tiles containing a photograph of the voter.

MyPosition was evaluated using observations, interviews, and through analysis of the log files. From this, several conclusions were drawn. The installation successfully managed to attract people to vote (217 out of 880 passers-by), though people were more reluctant to vote when the tiles showed photographs of voters. The majority of the interviewed voters placed votes that matched their actual opinions. The researchers identified several zones of engagement, and especially in the area slightly further away from the screen deeper discussions were held on the topics presented in the visualisation, the results, and the privacy issues of public voting. Valkanova et al. conclude that MyPosition managed to engage people, spark discussion, and encourage informal and playful behaviour such as nudging – similar to the Tidy Street and Reveal-it! studies.

Objective: research

Evaluation of impact: observations, interviews, and data logs

Types of engagement installation was designed to evoke: noticing, understanding, participating, discussing

Types of engagement evoked by installation: noticing, understanding, participating, discussing, championing



### 2.3.2.9 Street Infographics

Claes et al. (Claes and Vande Moere, 2013) deployed four non-digital street signs visualising socio-demographic data. The signs were situated in an area of Leuven (Belgium) known to not be very socially connected. Furthermore, the planning of new student housing had caused commotion in the area, with permanent residents expressing concerns over the balance between students and permanent residents. The design of the street signs was based on the characteristics defined by (Vande Moere and Hill, 2012). All signs were deployed for one week. During this time, the researchers took field notes, sketches, pictures and video clips. Furthermore, interviews with a number of passers-by were conducted, of which half were conducted with local residents. Reactions to the street signs varied, ranging from curiosity to discussions between local residents. In addition, people expressed having learnt more about the local socio-demographic composition, and sometimes having changed their viewpoint based on this new information. Claes and Vande Moere (2013) emphasise the need for more research to establish the impact of these type of public visualisations, and to determine the effect the display has in communicating information.

Objective: research

Evaluation of impact: observations and interviews

Types of engagement installation was designed to evoke: noticing, understanding, discussing

Types of engagement evoked by installation: noticing, understanding, discussing

### 2.3.2.10 Smart Citizen Sentiment Dashboard

The Smart Citizen Sentiment Dashboard, created by Behrens et al. (2014), was deployed in the financial district of Sao Paulo (Brazil). Consisting of an input device (happy smiley, neutral smiley, sad smiley) and an output LED façade. The input device allows passers-by to vote on different “urban challenges”, ranging from the environment and transport to housing and safety. Votes are publicly shown on the LED façade, via which a sunburst infographic was displayed.

In total, the installation was deployed for 7 days. During this period, nearly 600 interactions with the input device were recorded. To prevent people from voting multiple times, par-

ticipants had to scan their RFID-enabled travel card to cast a vote. This was, however, also found to limit engagement, as not all passers-by possessed these travel cards. From observations and analysis of the logged data, Behrens et al. distinguish between different types of participation with the installation, such as serious participation (i.e. submitting a single vote), repetitive participation (i.e. submitting same vote multiple times), and playful participation (i.e. submitting multiple different votes). Engagement with the façade was only evaluated in a limited manner, but revealed that people regularly took photos of the display.

Objective: research

Evaluation of impact: observations and data logs

Types of engagement installation was designed to evoke: noticing, understanding, participating

Types of engagement evoked by installation: noticing, understanding, participating

These projects suggest that the design of accessible input technology and easy-to-comprehend visualisations public visualisations can facilitate different types of engagement, such as noticing, approaching, understanding, participating, discussing, and sometimes even changing behaviours. The literature shows that such public visualisations can successfully encourage people to consider and talk about the topics they address. The projects reveal that the type of displays used – in terms of size, novelty, visual mapping, and affordances – play an important role in evoking these types of engagement. Similarly, when the interaction mechanism or representation is problematic, for example by not being accessible or being counter-intuitive, it can deter engagement.

Collectively, the public visualisation projects conducted by artists and researchers provide some initial insights into how best to design these types of urban installations. However, the impact of many of the projects was often not evaluated as they were conducted as part of artistic interventions rather than academic studies – and as a result little is known about how different aspects of the design impacted engagement. Furthermore, the work is piecemeal, as there are not yet any frameworks, taxonomies, design guidelines or other types of more generalisable knowledge. Vande Moere and Hill (2012) have made a start with formulating design constraints typically characterising public visualisations situated in urban environments, based on the analysis of several existing visualisations. They present three determinant de-

sign characteristics, arguing that in order to be effective these kinds of installations should be: situated (*“the visualisation is embedded in the real-world, physical environment”*), informative (*“the data are different from those on posters and electronic announcement billboards in several ways”*), and functional. For each of these characteristics, they outline a set of sub-characteristics, as shown in Table 2.4.

<i>Situated</i>	
Contextual	The design of the visualisation takes the characteristics of the environment into account, to convey both explicit and implied meaning (e.g. metaphors)
Local	The visualised data has a direct link to the location it is shown in
Social	The visualisation addresses local issues
<i>Informative</i>	
Feedback	The visualisation provides <i>“a direct feedback loop between the city, its inhabitants and their actions”</i>
Insightful	The visualisations enables people to create new insights
Consistent	The visualisation does not contradict itself (e.g. if it is about sustainability, the display should be sustainable)
<i>Functional</i>	
Medium	The visualisation is chosen so that it can engage a large and diverse audience
Participative	The visualisation can engage many, potentially encouraging <i>“participative and collaborative action”</i>
Opportunistic	The visualisation stays in the periphery, not disturbing everyday urban life
Aesthetic	The visualisation’s design takes the environment into account and blends in
Trustworthy	The visualisation shows data in an objective, fair, and trustworthy manner
Persuasive	The visualisation encourages reflection, change, or action

**Table 2.4:** Public visualisation characteristics identified by Vande Moere and Hill

In conclusion, the review of previous projects that deploy public visualisations in urban settings highlights two main gaps in research: a) the lack of empirical studies examining the impact of public visualisations, and b) the lack of generalisable knowledge, such as guidelines, taxonomies, and frameworks, that can support researchers and designers.

This thesis aims to address these gaps by developing a more systematic approach to designing *urban visualisation* interventions. Such urban visualisation interventions encompass both the

process of collecting data and the public visualisations of this data in the same urban setting – with the aim of engaging people with local topics:

**Urban visualisation** The public and situated collection and display of local or hyperlocal data in the urban environment

More specifically, this thesis aims to extend previous work in the areas of community technology and public visualisations by investigating if and how design and deployment characteristics influence the effectiveness of urban visualisation interventions. It plans to do so by examining the role of these characteristics through a series of empirical studies, and developing a set of frameworks that can guide researchers and designers. The employed research methodology will be described in more detail in the following chapter.

## 2.4 Summary

The study of community technologies has increased in popularity in recent years, with a number of researchers investigating how technology can support people living and working in cities. Two types of technologies have played a key role in engaging people in these urban settings: public input devices and public displays. Previous work has demonstrated that such situated technology can evoke diverse types of engagement, including: participation, collaboration, and discourse. Furthermore, the study of ambient displays has shown that public visualisations can also successfully encourage people to engage, for example by noticing, interpreting, and discussing the displayed data. The use of public visualisations in the urban environment, however, is relatively novel and unexplored. A review of previous public visualisations displayed in urban settings revealed two main gaps in this area of research: a lack of empirical studies and a lack of generalisable knowledge, such as guidelines, frameworks, and taxonomies. This thesis aims to address these gaps by developing a more systematic approach to designing urban visualisation interventions, consisting of publicly situated input technologies and visualisations. Through a series of empirical studies, this thesis aims to develop an urban visualisation framework that maps how design and contextual factors affect engagement.

In the next chapter, the research methodology employed in this thesis is set out. This chapter describes the in-the-wild research approach, how the study settings were selected, and how

the prototypes were developed. Furthermore, it outlines the data collection and analysis process, and provides an overview of the collaborators involved in each study.



## Chapter 3

# Research methodology

### 3.1 Research approach

To investigate the role that different aspects of urban visualisations can play in evoking community participation, an in-the-wild research approach was adopted. The primary objective of conducting in-the-wild studies is to examine engagement with technology in the ‘real world’, in settings where this type of technology would typically be used. While a variety of definitions of such user engagement exist (O’Brien and Toms, 2008), the following definition is used in this thesis to describe engagement with community technology:

**Engagement** The experience of being actively involved with technology, as evidenced by behaviours such as curiosity, participation, discussion, and championing.

This definition draws heavily on the following description by Gaver et al. (2009, p. 2219) on how user engagement can be measured:

*“Beyond any explicit declaration of liking (which, after all, might be made out of sheer politeness), we take as evidence such things as an enthusiasm about discussing the design and their experience with it; persistence in use and interpretation over time; suggestions for new enhancements that reflect our original design intentions, showing the prototype to friends; disappointment that the field trial must end, and expressions of desire to own the prototype.”*

By embedding the technology in its intended setting, and capturing the context of use in the evaluation (Rogers et al., 2007), in-the-wild research aims to have high ecological va-

lidity. The in-the-wild research approach is relatively new within HCI, having emerged in mid-2000s. The approach builds on earlier ethnographic approaches, however, unlike these approaches, in-the-wild studies often introduce prototypes or other types of interventions, whereas ethnographic research studies settings as they are (Rogers, 2012, p. 73). Previous in-the-wild studies have examined a wide range of prototypes, ranging from interactive tabletops (Hinrichs and Carpendale, 2011) to service robots (Forlizzi and DiSalvo, 2006), and digital bins (Thieme et al., 2012). The introduction of such prototypes allows researchers to study how people use and appropriate the technology within their intended context – including in ways that may not have been anticipated during the design phase of the prototype.

The key strength of the in-the-wild research approach is the study of technology in its natural setting. This, however, is also one of its main challenges: in contrast to traditional lab studies, in-the-wild studies are largely uncontrolled. Whereas in lab studies a number of factors are controlled by the researchers – such as the setting, the participants that take part, and the activities that the participants engage in – researchers conducting in-situ studies have little to no ability to manipulate the factors that affect the study. For example, the ‘real-world’ settings are likely to change throughout the deployment. In the context of studies in public settings this means a variety of changes may occur, including changes in weather and the physical layout of the setting. Similarly, the participants that take part are people who happen to come across the technology. This may mean that the typically desired balance of demographics of the participants is not achieved. Furthermore, as the researchers have no influence over the people moving around in the chosen setting, the number of people engaging with the technology may be highly unpredictable, in particular in public and semi-public settings. In addition, the researchers have no control over type of engagement that participants have with the technology, and they do not typically play an active role in guiding or supporting participants. As a result, participants may not use or appropriate the technology as it was intended to. As the nature of in-the-wild studies does not allow for the isolation of these types of effects, it is generally hard to pinpoint why effects take place (Rogers, 2012, p. 73). This makes the data collected during in-the-wild research more difficult to analyse. Embedding prototypes in the ‘real world’ also introduces a number of other methodological questions around the length of studies (Rogers, 2011), the role of the researcher (Johnson



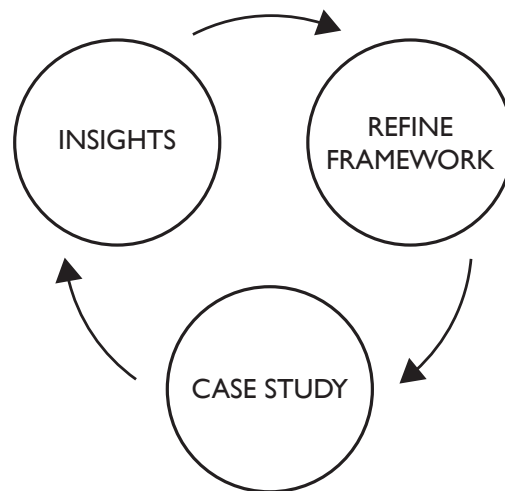
et al., 2012), how to manage initial access and consent (Reeves, 2011), and how to manage handovers after deployments (Taylor et al., 2013).

However, while the in-the-wild approach has limitations and methodological challenges, it offers the ability to study usage of technology in its intended setting. Previous studies investigating interactions with publicly situated displays have, for example, shown that the in-the-wild approach can provide valuable insight into the social interactions that take place around such displays (e.g. Fischer and Hornecker (2012); Peltonen et al. (2008); Taylor and Cheverst (2009)), and the effect of the setting on these interactions (e.g. Akpan et al. (2013); Behrens et al. (2013)). This work has also emphasised the value of the researcher being located in the intended setting throughout in-the-wild studies, in order to get a thorough understanding of the context, and the role of the context on the design of the technology, as highlighted by North et al. (2013):

*“Embedding the research team and their developed artefacts into the target community, may lead to a more thorough understanding of how that community functions and how such functionality impacts community expectations in terms of the delivered artefacts. These expectations might relate to the artefact’s form, function or meaning. With a researcher’s increased awareness of the underlying dynamics in the community, greater insight into the web of conflicting user requirements may emerge.”*

For this thesis, the inclusion of the target setting (i.e. public spaces) in the study was deemed key, in particular for the study of the types of engagement with the input technology and public visualisations. For this reason an in-the-wild approach was employed. As the findings from individual in-the-wild studies are often difficult to generalise, due to the lack of control on the factors affecting the study, a series of studies were conducted. By deploying technology in a diversity of settings, the findings from the individual case studies were validated in an iterative manner, thereby building up a framework over time, as shown in Figure 3.1.

The iterative process not only made it possible to validate the insights from the individual case studies over time, it also provided the option to address emerging research questions, and to make changes to the design of the subsequent prototypes and study settings accordingly. This flexible approach enabled the gradual development of understanding around the design



**Figure 3.1:** Iterative approach: developing a framework through a series of case studies

of effective prototypes. As a result, the design of these prototypes was increasingly informed by the insights from the previous case studies.

A total of six case studies were conducted, in several types of settings (see Section 3.2). All case studies were of short to medium length, ranging from one day events to deployments of approximately one month. While there are ongoing discussions about the appropriate study length of in-the-wild deployments (Rogers, 2011), the objective of these case studies was not to investigate the sustainability of the engagement with the technology. The length of the studies was primarily determined by practical factors, such as the type of setting, and the input from the local community and other involved organisations (see Section 3.2).

## 3.2 Selection of settings

This thesis describes a series of case studies. These studies were initiated in various ways: in one instance the researcher was approached by a community group, and in other instances the researcher approached organisations or local councils. An overview of how each study was initiated can be found in Table 3.1.

A balance was sought between types of settings, in order to examine the role of input technology and public visualisations in neighbourhood settings as well as event settings (see Table 3.2) – both of which play an important social role in cities. All studies took place in the cities of London and Cambridge (UK). The selection of settings was often opportunistic,

How study was initiated	
Case studies	
I: Visualising Mill Road	Existing connection to community leader
II: Fair Numbers	Researcher approached by community group
III: VoxBox	Festival organisation approached by researcher
IV: VoxBox Reappropriated	Researcher approached by festival organisation
V: Scribbles, Magnets, Typewriter	Building manager approached by researcher
VI: Urban Typewriter	Local council approached by researcher

**Table 3.1:** Overview of how case studies were initiated

and dependent on existing links to communities, and the willingness of local organisations and councils to take part. The quest to find neighbourhoods that would be able and willing to participate proved highly time-consuming, and was often unsuccessful. While interest in taking part was typically high amongst active residents (e.g. members of community groups), practicalities – such as the complications around obtaining permission to deploy technology – regularly prevented projects from materialising.

Within the different settings, specific locations and venues were selected where the input technology and public visualisations would be situated. The type of setting generally influenced the number of locations that were used per deployment. Again, a balance was sought between attempting to engage as many people as possible, limiting complexities around the development and maintenance of prototypes, obtaining permission, and studying usage in-situ. The diversity of settings also impacted the study length: whereas event settings typically only existed for short durations (1 to 2 days), in neighbourhood and workplace settings it was possible to conduct longer deployments (see Table 3.2). The length of all studies was also informed by factors relating to the specific setting, such as the duration local venues were willing and able to host technologies for (e.g. Chapter 4, 8, and 9), and the length of the consultation period set by the council (e.g. Chapter 9).

### 3.3 Prototypes

To investigate the role that situated input devices and public visualisations can play in encouraging community participation, this thesis describes the design, deployment, and evaluation of a range of prototypes. These prototypes were designed as a means to examine different aspects of situated feedback installations, such as the type of input method, place-

	Type of setting	Study length	Locations
I: Visualising Mill Road	Neighbourhood	24 days	18
II: Fair Numbers	Event	1 day	4
III: VoxBox	Event	2 days	2
IV: VoxBox Reappropriated	Event	2 days	1
V: Scribbles, Magnets, Typewriter	Workplace	15 days	3
VI: Urban Typewriter	Neighbourhood	16 days	3

**Table 3.2:** Overview of study length, type of setting, and the number of involved locations for each case study

ment, and update frequency. The practice of deploying research prototypes is an established method within HCI, with many researchers using such prototypes to study how people use and appropriate technology in the home (e.g. Gaver et al. (2013); Odom et al. (2014)), office (e.g. Gallacher et al. (2015); Rogers et al. (2010)), or public settings (e.g. Fortin et al. (2014b); Laureyssens et al. (2014)).

All prototypes were developed iteratively, starting from initial concept sketches, to paper and cardboard mockups, to fully developed and deployable research prototypes. This process was informed by the setting, existing literature on the design of publicly situated technology, and the case studies described in this thesis. This design process is described in detail in each case study chapter. While, by definition, prototypes are preliminary versions of the final, completed product (e.g. a commercial voting device), the prototypes that were deployed in the various case studies were of a high fidelity. As the prototypes were placed in-situ for durations ranging from one day to four weeks, they were required to be robust as well as easy to repair or debug. The studies in this thesis are presented in chronological order as well along a spectrum from restricted to open-ended, ranging from voting to using more nuanced sliders to free text input.

### 3.4 Data collection and analysis

In all in-the-wild studies described in this thesis, a mixed-methods approach was employed. Previous work has shown that a combination of methods can help uncover different aspects of engagements, such as the combination of observations, surveys, and logs (Rogers et al., 2010), observations and video recordings (Hinrichs and Carpendale, 2011), or diaries and interviews (Inglesant and Sasse, 2010). As highlighted by Rogers et al., it is impossible, and

often undesirable, to capture everything when studying deployments in-situ, and instead a combination of methods should be used “*that reveal both hoped for and unexpected effects of the context of use*” (Rogers et al., 2007). For each study, therefore, appropriate methods were selected to best capture engagement. This selection of methods was also influenced by the restrictions imposed by the different settings. For example, video recordings were not permitted in all settings, and as a result longer in-situ observations had to be conducted in order to capture similar highly detailed data about people’s engagement with the installations.

The focus of the data collection and analysis was on the use of qualitative methods to evaluate people’s engagement with the installations. As the situated deployment of input technology and visualisations in public settings is still highly exploratory, qualitative methods were employed to get a better understanding of the factors that affect engagement with such installations. The methods adopted in this thesis include observations, semi-structured interviews, and video recordings. While the studies primarily used qualitative data, quantitative data from the logs captured by the deployed installations were also included, as explained below. An overview of the methods used for each study can be found in Table 3.3.

	Data logs	Observations	Interviews	Video recording
Case studies				
I: Visualising Mill Road	✓	✓	✓	-
II: Fair Numbers	✓	✓	-	-
III: VoxBox	✓	✓	-	✓
IV: VoxBox Reappropriated	✓	✓	-	✓
V: Scribbles, Magnets, Typewriter	✓	✓	✓	-
VI: Urban Typewriter	✓	✓	✓	-

**Table 3.3:** Data collection methods

As shown in Table 3.3, during case study I Visualising Mill Road data logs from the deployed technology was captured and analysed. In addition, observations and interviews were conducted throughout the 24-day deployment. The study setting, which focused on shops in a residential neighbourhood, did not allow for video recordings of interactions, as shops were typically very small, and several shopkeepers expressed being uncomfortable with either their shops or their customers being photographed or filmed. Case studies II, III, and IV focused on event settings. The technology interventions deployed at these events aimed

to encourage people to consider their experience of the event in a playful and lightweight manner. The decision was made not to conduct interviews with participants at these events, as the act of conducting such interviews was deemed too obtrusive for the temporary nature of the setting. Instead, video cameras were placed in the settings with fixed technology interventions, namely the VoxBox studies, in order to conduct a detailed analysis of all interactions. Case studies V and VI did not allow for the deployment of cameras, as this would have affected people's privacy in these settings – which was deemed particularly important in, for example, the office setting, and the community centre setting in which people attended therapy sessions. Instead, semi-structured interviews were carried out to support the evaluation of the prototype devices.

### 3.4.1 Data logs

All prototype devices deployed in the case studies described in this thesis were designed to record all direct interactions. All logs captured the location (e.g. *'supermarket'*), time (e.g. *'10:15:20'*), and type of interaction (e.g. *'yellow vote'*). The main purpose of this data was to keep a detailed recording of all direct interactions, including those that were not directly observed by researchers.

The data logs of each study were used to determine levels of engagement with the devices at different locations and different times in a quantitative manner. Per study, appropriate data cleaning processes were put in place (e.g. removal of empty message, removal of repeat votes). The filtered data was then used to provide descriptive information for each study, such as the total number of interactions, number of interactions per location, type of interactions, and popular interaction times. This quantitative data was primarily used to describe engagement levels and inform the qualitative methods, and was deliberately not gathered for the purpose of statistical analyses.

### 3.4.2 Observations

During all case studies, observations were conducted. The objective of these observations was to gather information on who engaged with the installation (from noticing to direct interaction) and how. An important part of this was the observation of social interactions near the installation, to find out whether people talked it – and if so, what they discussed.

In addition, observations were conducted to capture types of engagement that were not anticipated.

Typically, the researcher stood, or sat, in the vicinity of the deployed installation, and kept a record of notes and sketches of all engagements with the installation, either digitally or on paper. These notes captured the location (e.g. *'library'*), time (e.g. *'13:30'*), a description of the people involved (e.g. *'2 adults  $\pm$  40 y.o. male, 1 child < 15 y.o. female'*), and their behaviour (e.g. *'man 1 notices installation, but is called by child and walks away'*). The notes from all studies were digitised, and analysed thematically. The notes were annotated based on reoccurring themes in the data (e.g. *'active championing'*, *'honeypot effect'*, etc.). These annotations were then used to compare types of engagement, and to quantitatively identify common behaviours.

### 3.4.3 Interviews

Semi-structured interviews were conducted during several case studies. The interviews were conducted with various types of participants, including those who were observed interacting with the installation, those passing by but not engaging, and those identified as active community leaders. The objective of these interviews was to find out if, how, and where people had discovered the installation, how they had engaged with it, and their opinions on the installation and the topics it addressed. Interviews were semi-structured in order to address all topics, while allowing participants to freely express themselves. Where possible, questions were posed in an open-ended manner, to encourage participants to describe their experiences in detail. During studies in neighbourhood settings, where the researcher could not personally observe all engagements due to the distribution of prototypes and the duration of the deployments, identified established leaders within the community (e.g. shopkeepers, organisers of community groups, etc.) were treated as informants. During the semi-structured interviews, these people were asked not only about their own participation but also about their observations of, and conversations with, other people. This approach follows on from work by Brown et al. (2011) on treating lead participants as investigators. Where possible, and with the participants' consent, interviews were recorded, and later transcribed. In all other instances, notes from the interviews were captured on paper by the researcher.

The data from all interviews was digitised, and analysed thematically. Similar to the notes from the observations, all interview data was annotated based on reoccurring themes in the

data (e.g. *'returned to installation multiple times'*, *'talked about installation with others'*). Again, annotations were used to compare types of engagement, and to identify frequently addressed themes.

### 3.4.4 Video recordings

During two deployments at events (the VoxBox case studies, Chapters 6 and 7), video recordings were taken throughout the day. Two to three cameras were positioned around the installation, to capture how people approached it, how they engaged with the input technology, and how they engaged with the public visualisations. The main objective of the video recordings was to capture all responses to and interaction with the installation in detail. This, for example, allowed for a highly detailed analysis of how long (in seconds) people engaged with different elements of the installation.

A log was created of all captured engagements, recording the time stamp on the video (e.g. *'04:02'*), actual time (e.g. *15:09*), people (e.g. *'1 adult ± 60 y.o. female'*), how they approached the installation (e.g. *'discovers input first, later walks to visualisations after noticing people standing there'*), and their behaviour (e.g. *'observes from a distance, does not interact directly'*). After all recordings were logged, themes of frequently observed behaviours started to emerge (e.g. *'collaborate'*, *'point to visualisations'*). Using the logged time stamps all engagements were analysed an additional time, to study in detail how often these behaviours occurred, and in what circumstances. This information was added to the log.

## 3.5 Collaborations

Due to the scale and logistics of the in-the-wild deployments, all studies were carried out in collaboration with other organisations and researchers. However, all data analysis and evaluation described in this thesis were conducted solely by the author of this work (referred to as the researcher). Descriptions of who was involved in which aspects of the different studies can be found below. All studies were conducted under the supervision of Professor Yvonne Rogers.

Chapter 4 describes the Visualising Mill Road study, a collaboration between Dr Vaiva Kalnikaitė (ICRI Cities, UCL / Dovetailed) and the researcher. The concept design was developed collaboratively. The technical implementation of the voting device was developed by Dr Vaiva Kalnikaitė and Dr Nicolas Villar (Microsoft Research). The visualisations



were sprayed onto the pavement by a team of local artists: Dan Biggs, Ceri Ann Littlechild, Jemma Timberlake, and David Wood. The artists were paid for their time. Permission was given by Cambridge Council to deploy the input devices and visualisations. The participating shops included: Bacchanalia, Black Cat, Bosphorus, Cafe Coco Belle, CB1, Cho Mee, Computer Resale, H. Gee, Hillary's Greengrocers, Interflora, Kailash, Limoncello, Mini Market, Oxfam, Raj, RSPCA, Sally Ann, and Urban Larder. Background information, shop suggestions, and question suggestions were provided by shopkeepers and members of the community groups Mill Road Bridges and the Mill Road History Project – in particular: Caroline Wilson, Pamela Wesson, Becky Proctor, and Lucy Walker. All data collection and data analysis was conducted solely by the researcher.

Chapter 5 describes the Fair Numbers study, a collaboration between Dr Vaiva Kalnikaite and the researcher. The conceptual design was developed collaboratively. The voting application was developed by Dr Sarah Gallacher (ICRI Cities, UCL), and the Smart Citizen Kits were provided by Tomas Diez (ICRI Cities, UCL / Fab Lab Barcelona). During the event, a team of people helped with the data collection: Tomas Diez (ICRI Cities, Fab Lab Barcelona), Dr Sarah Gallacher (ICRI Cities, UCL), Stephen Gallacher, Dr Vaiva Kalnikaite, Mansha Manohar, Dr Gabriel Villar, Dr Lorna Wall (UCLIC, UCL), and the researcher. All data analysis was conducted solely by the researcher.

Chapter 6 describes the VoxBox study, a collaboration between Dr Sarah Gallacher, Dr Connie Golsteijn, Dr Lorna Wall, Sami Andberg, and the researcher. The conceptual design, technical implementation, and construction of the VoxBox were conducted by Dr Sarah Gallacher and Dr Connie Golsteijn. The design and implementation of the visualisation side was carried out by the researcher. Data collection (videos and observations) was conducted collaboratively. All data analysis described in this thesis was conducted by the researcher. Chapter 7 describes the study of the reappropriated VoxBox, designed to engage children and adults about perceptions around science. The redesign was, again, a collaboration between Dr Connie Golsteijn, Dr Sarah Gallacher, and the researcher. All data collection and analysis was conducted solely by the researcher.

Chapter 8 describes the Scribbles, Magnets, Typewriter study, conducted in collaboration with Dr Sarah Gallacher. The conceptual design and construction were carried out collab-

oratively. The technical implementation was developed by Dr Sarah Gallacher. All data collection and analysis was conducted solely by the researcher.

Chapter 9 describes the Urban Typewriter study, conducted in collaboration with Dr Sarah Gallacher. The technical implementation was developed by Dr Sarah Gallacher. The construction was carried out collaboratively. The question was provided by Croydon Council, who also arranged the involvement of the three deployment locations: Ashburton Library, St. Mildred's Church, and Woodside Primary School. Data from the online and paper survey were provided by Croydon Council. Data collection and analysis was conducted solely by the researcher.

### 3.6 Research ethics

The studies in this studies had ethical approval from University College London (application number UCLIC/1415/005/ICRI Rogers/Capra/Gallacher). In all settings posters and information sheets were used to inform passers-by and participants about the aim of the study, the involved researchers and university, the main researcher's contact details, and how collected data would be handled according to the Data Protection Act 1998. Informed consent was obtained from participants who agreed to be interviewed. Consent forms were used to inform people about the aim of the research, how collected data would be handled, and how they could withdraw from the study at any time, without giving a reason. It was not possible to obtain informed consent for subjects of observations or for individuals who were captured on video, as most studies took place in busy, public settings, and because of the need to be able to observe naturalistic interactions with technologies. Observations of this kind are in line with the BPS Code of Human Research Ethics <sup>1</sup>, and APA Ethical Principles of Psychologists and Code of Conduct <sup>2</sup>. Furthermore, where video cameras were used to capture interactions, a researcher was present to explain the study and to allow people to opt out, resulting in footage of them being deleted. As described in Section 3.4, data collection methods were selected with care and adapted to the context of the setting (e.g. no filming in settings where this may be deemed obtrusive, whether for spatial, social, or other reasons).

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<sup>1</sup>BPS Code of Human Research Ethics - [http://www.bps.org.uk/system/files/Public%20files/code\\_of\\_human\\_research\\_ethics\\_dec\\_2014\\_inf180\\_web.pdf](http://www.bps.org.uk/system/files/Public%20files/code_of_human_research_ethics_dec_2014_inf180_web.pdf), retrieved January 2015

<sup>2</sup>APA Ethical Principles of Psychologists and Code of Conduct - <http://www.apa.org/ethics/code/>, retrieved January 2015

### 3.7 Summary

To study engagement with situated input technology and public visualisations, an in-the-wild research approach was adopted. Diverse settings, including events, neighbourhoods, and an office, were selected to evaluate different research prototypes. For each case study, suitable and practicable evaluation methods were selected, such as in-situ observations, semi-structured interviews, and video recordings. An iterative process was employed, whereby the findings from each of the studies described in this thesis were used to inform the subsequent studies. This approach was used to validate the findings in a diversity of settings. As a result, the design of the studies and prototypes was informed by the selected settings, literature, and findings from the previously conducted case studies.

The next chapter presents the first case study, Visualising Mill Road, a deployment of situated voting devices and visualisations along a high street in a residential community, which was informed by the findings from the literature review.



## Chapter 4

# Case Study I: Visualising Mill Road

### 4.1 Introduction

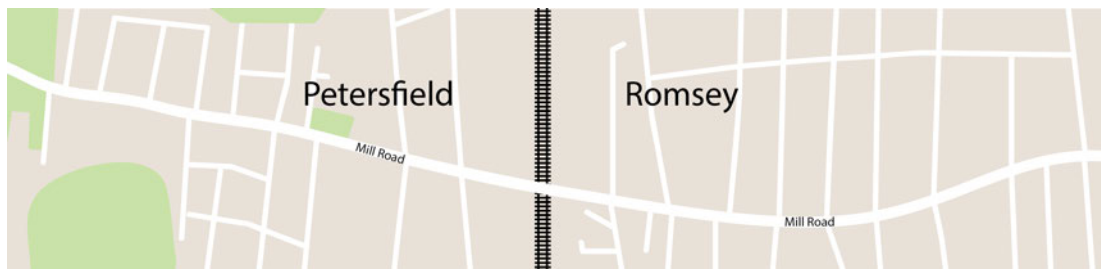
The literature review and two formative studies (described in Appendices A.1 and A.2) revealed a number of challenges related to public displays. To investigate some of these issues in more detail, the first in-the-wild case study was conducted: Visualising Mill Road. The aim of this study was to further examine if and how a highly situated approach, with a clear coupling of input and output, could foster local engagement with themes identified by the local community.

This chapter describes the design, deployment and evaluation of simple voting devices, that enable people to express their views by pressing either agree, neutral, or disagree. These voting devices were distributed throughout a neighbourhood in Cambridge and used to pose a wide range of questions to people working and living in the area. Questions were sourced from the local community. All collected data was then publicly displayed on the pavement via visualisations distributed throughout the area. The deployment was specifically used to investigate the use of community-generated topics, voting as an input method, and the delayed updating process of the visualisations.

This study was carried out in collaboration with Dr Vaiva Kalnikaitė (see Section 3.5 for more details).

#### 4.1.1 Setting

The Visualising Mill Road study focused on the neighbourhood setting of Mill Road. This one-mile long street is located in southeast Cambridge (UK), near the city's railway station.



**Figure 4.1:** Map showing Mill Road and the railway track that divides the street

This street was selected for two reasons: a) a pre-existing social connection to an active community member made it possible to get in touch with several community groups and a council representative in a short period of time, b) Mill Road’s rich history and reputation of being a bustling community locale with many independent shops and cafes.

In the mid-19th century a railway line was constructed that passes through Mill Road. A railway bridge was introduced to connect the two ends of the street again (see Figure 4.1). The arrival of this railway, and the railway bridge, drastically changed the character of Mill Road. Not only did the street become an increasingly popular destination for those shopping in Cambridge, the railway also created an urban divide. The area west of the railway, known as Petersfield, was originally built by the University of Cambridge, to provide housing for its staff members. The area east of the railway, known as Romsey, historically had a more working class demographic, as this area was developed to house the workers building the railway line. The people living in these two areas had very different incomes, lifestyles, and political outlooks. For example, Romsey received the nickname ‘Red Romsey’ because of the prevalent socialistic outlook of its residents. The political and socio-economic differences between the people on the two ends of the street caused a divide. Residents actively stayed on “their” end of the street for shopping and socialising, often referring to “us” and “them” when talking about Petersfield and Romsey, or vice versa.

Nowadays, Mill Road is a nationally renowned street, popular for not only its range of independent shops, but also the many local festivities. The stark differences between the demographics of Petersfield and Romsey have largely faded over time. However, the divide appears to persist. One community group has been set up specifically to attempt to bridge the gap, and several other community groups actively organise activities that span both ends of the street. Despite these efforts, many locals still perceive a difference, and the ‘us versus them’ mindset remains prevalent till date.

During the exploratory phase of the study it became apparent that local community groups had one key interest: encouraging people along Mill Road to reflect on and discuss the street's divide. They believed that fostering discourse might open up the conversation about the divide, and in particular the similarities and differences between Petersfield and Romsey, which are currently rarely spoken about. Moreover, the three involved community groups hoped to learn more about the perceptions about Mill Road held by the wider community — especially those who are less, or not at all, involved in the community groups and festivities.

#### 4.1.2 Research objective

The specific research focus of the Visualising Mill Road study was on the use of community-generated topics, distributed voting technology and visualisations, and a delayed updating process (as shown in Figure 4.2). This focus is further detailed below.

CASE STUDY	TOPIC	INPUT	OUTPUT
I: VISUALISING MILL ROAD	COMMUNITY-GENERATED	VOTING (D)	DELAYED UPDATES (D)
II: FAIR NUMBERS	ENVIRONMENTAL	VOTING (D)	REGULAR UPDATES (C)
III: VOXBOX	EVENT FEEDBACK	MIXED (C)	REAL-TIME UPDATES (C)
IV: VOXBOX REAPPROPRIATED	PERSONAL	MIXED (C)	TAKEAWAY (C)
V: SCRIBBLES, MAGNETS, TYPEWRITER	OPEN-ENDED	TEXTUAL (D)	INTERACTIVE (C)
VI: URBAN TYPEWRITER	CONSULTATION	TEXTUAL (N)	DELAYED UPDATES (N)

**Figure 4.2:** Research focus of the Visualising Mill Road case study (D = distributed, C = central, N = nomadic)

The three community groups active in the Mill Road area were highly in favour of a project that would get people to think and talk about the topics that connect and divide the street. To this end, the study was focused on addressing a variety of topics along Mill Road. These topics were determined by, and in collaboration with, different members of the community, including shopkeepers and members of the community groups. This approach was used to investigate the following research question:

**VMR RQ1: How does the use of community-generated topics affect engagement?**

The aim of involving the community in determining topics was to identify themes that would be highly relevant, accessible, and topical to locals – which in turn was meant to make the posed questions inclusive and engaging.

To ensure people from different backgrounds, including those unfamiliar with technology, would be able to answer the addressed themes, the decision was made to explore the use of voting as the chosen input mechanism, building on the work by Taylor et al. (2012):

**VMR RQ2: How does the use of voting affect engagement and contribution quality?**

Furthermore, the aim of the study was to reach and involve the wider Mill Road community in reflecting and discussing on these topics. As described in Section 2.3.2, several projects have attempted to spark civic discourse in communities by deploying input technology and publicly broadcasting the output (e.g. Valkanova et al. (2014)). Though several studies have successfully managed to attract people to such publicly situated technology, they have been limited in how far they reach out to facilitate participation. In particular, most have only made use of a single location for input and output. As a result, the ability of the technology to engage with people in the community is limited to people happening to pass by, or those who are aware of, that specific location.

While it is generally easy to involve a small number of active community members, reaching out to a wider number of the population is far more challenging. How can interventions engage people living on the ‘poorer’ part of the street, elderly residents, those working night-shift and those only working but not living in the area to take part? In other words, how the design of urban technology interventions evoke more community-wide engagement? To investigate this, the decision was made to focus on the use of a distributed approach, where input technology was placed in different locations along the street.

**VMR RQ3: How does the distribution of input technology affect engagement?**

The aim of this distribution was to reach a wide variety of people, who live in, shop in, and work in different locations in the neighbourhood, by providing them with many entry points. In addition to distributing input technology, an equal number of visualisations were distributed along Mill Road. By situating the data visualisation and data source in close proximity, the intention was to provide a clear coupling between input and output.



**VMR RQ4: How does the distribution of visualisations affect engagement?**

Furthermore, through this study, the role of delayed visualisation updates was explored as a counter to the immediate live updating of visualisations, which by design requires the use of high tech visualisation methods.

**VMR RQ5: How do delayed visualisation updates affect engagement?**

Such a ‘slow’ approach was intended to evoke curiosity in the community, by giving people something to look forward to. In summary, the research focus of the Visualising Mill Road case study was on the use of community-generated topics, distributed voting technology, and distributed slowly updated visualisations.

## 4.2 Design

### 4.2.1 Conceptual design

At the start of the study, several meetings were arranged with Mill Road community groups, to gather more information on the history, characteristics, and challenges of the street. Members from three community groups participated, including a group dedicated to Mill Road’s history, a group dedicated to ‘bridging the divide’ and a group involved in organising local festivities. A handful of people were actively involved in more than one group. During this exploratory phase it became apparent how strong the divide between the Petersfield and Romsey areas is in everyday life, which was confirmed in interviews with shopkeepers and local residents in the followings weeks. Despite efforts from a community group to bridge the divide, shopkeepers as well as local residents stated they “rarely go to the other side of the bridge” and that they believed people on both sides of Mill Road had the same attitude towards “not wanting to go over the bridge”. According to a local resident and volunteer at one of the street’s charity shops this divide is particularly prevalent among those who are highly familiar with the area: *“I think if you use Mill Road frequently, live here or visit [frequently], you gradually become aware of the differences and then you make a conscious decision about where you are going or where you are not going. I don’t think there is any ‘no go area’, I think there is a tendency to be... the railway is an important invisible crossroads.”* The shop owner of one of the street’s oldest shops explained: *“The bridge divides. I suppose it is really a lack of familiarity, actually. Because lots of people don’t go over there. I do go more now, but years ago I never used to go – it was like the two*

*sides of the Thames, you know. The North and the South. It still has a slightly different feel over there. Which is interesting, same as London, curiously enough. What exactly it boils down to, I don't know".* Another shopkeeper added: *"I guess the bridge has a big effect. If that wasn't there, it would all seem like one big road. People talk about going over the bridge like it is going to another world."*

During conversations with the community groups and a council representative it became apparent that there was a strong interest in projects that could help connect Petersfield and Romsey. It also became clear that the views about 'the other side' were not often explicitly discussed, despite the fact that everyone seemed to feel strongly about this topic. Therefore, it was decided to focus the deployment on sparking discourse, and encouraging people to reflect on their perceptions of Mill Road.

#### 4.2.2 Topics

Based on the conversations with the community groups, shopkeepers and residents, a set of topics was identified that locals considered to be timely, topical, and relevant to people along the whole street. The decision was made not to address the Mill Road divide directly, but to instead ask questions related to the divide. The aim of this approach was to prevent 'us versus them' competition, and to instead encourage discussions about themes relevant to people along the whole street. Although the active residents had several suggestions for topics they felt should be addressed, they had difficulty coming up with specific questions. Eventually, a list of suggested topics was composed. These suggestions were then transformed into questions and statements by the researchers. The formulated questions and statements were discussed and iterated with the community groups – and after several iterations, a set of 7 was finalised:

- Q1: How do you feel today? (theme: *happiness*)
- Q2: How well do you know your neighbours? (theme: *neighbourliness*)
- Q3: Mill Road is safe (theme: *safety*)
- Q4: Mill Road feels like home (theme: *community*)
- Q5: I like to shop locally (theme: *local shopping*)
- Q6: Mill Road is buzzing today (theme: *street buzz*)
- Q7: I know lots of people around here (theme: *social ties*)

Several shopkeepers and residents indicated that they wanted to think about relevant topics for a longer period of time. To facilitate this, additional suggestions were collected during the deployment. The following two statements were added during the study, based on their additional suggestions:

Q8: I am happier on this side of the bridge (theme: *localism*)

Q9: The future of Mill Road is bright (theme: *future*)

For the purpose of community-wide participation, all suggestions had to comply with one condition: the topic had to be of relevance to people along the whole street. Suggestions that were only relevant to the (commercial) interests of one shop or person were omitted. It was also decided that the questions and statements had to be kept short, to allow people to read them at a glance while standing near the till of a shop. Slightly ambiguous topics like safety were not clarified further (e.g. by specifying if it addressed road safety or the risk of pickpocketing) with the idea that the ambiguity could encourage discussion.

### 4.2.3 Input technology design

To enable people along Mill Road to participate and express their views, a series of voting devices were designed and developed. Building on the findings from Taylor et al. (2012), the choice was made to make use of simple physical push buttons, allowing people to take part and communicate their choice at the press of a button. This input method was adopted to ensure that the project would be accessible to people from different ages and backgrounds. The decision was made not to make use of off-the-shelf devices, such as touch screens, mobile phone apps or web-based interfaces as this would mean having to ask people to download an app or for the shopkeepers to set up and maintain a touch screen in their shop. Furthermore, display blindness would have likely affected the participation rate. Instead, a custom device was developed, designed to be salient and easy to use. Due to its simplicity and familiarity, this type of voting interaction requires no learning for the vast majority of people. The questions and statements posed via the voting devices were made concise, and the options to answer them straightforward: agree (happy smiley), neutral (neutral smiley), disagree (sad smiley). These options could be selected via one of three large colourful push-buttons, designed to attract attention. This minimal approach, whereby only three choices were provided, was chosen to allow people to give their opinion quickly and easily. The constraint of

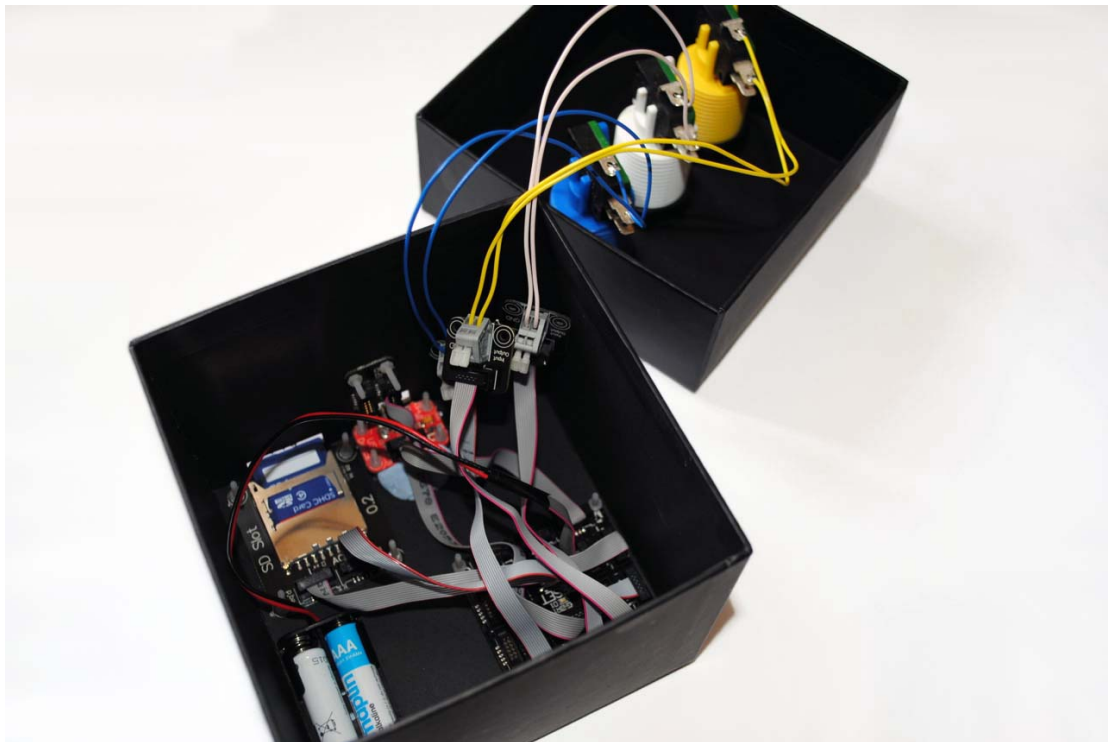
three options was intended to provoke public discourse around the voting devices between the people shopping and the shopkeepers, as the device forced them to communicate their perspective in a highly restricted manner.



**Figure 4.3:** Voting devices: a) lo-fi Lego prototype, b) hi-fi prototype, c) final version.

A low fidelity Lego prototype of the voting device (see Figure 4.3a) was presented during meetings with local community members, together with sketches of the final version. The feedback elicited during these sessions suggested that the concept of three large smiley face buttons, in order from happy to sad, was entirely clear. However, it also emerged that the device would have to be larger in size, both to attract attention and to display the question in a more readable manner. Based on these findings, a larger high fidelity prototype was built, using a cardboard box (see Figure 4.3b). Though the initial idea was to use 3D-printed or wooden boxes, the high fidelity prototype revealed that strong cardboard was a suitable, cheaper, and more practical material. The final voting devices (see Figure 4.3c) were built using black cardboard boxes. All holes required for buttons, screws, a power cable, an LED module, and an SD card were laser cut into the material. Three arcade game buttons were installed on the top. Inside, Microsoft Gadgeteer hardware modules were used to log votes onto an SD card (see Figure 4.4). The internal clock, designed to record the timestamps

of all votes, was connected to an additional battery pack to ensure that the clock would be running continuously, even when the voting device itself was disconnected from power.



**Figure 4.4:** The inside of a voting device, with Microsoft Gadgeteer hardware modules screwed into the bottom

The voting devices were designed to be connected to the mains. Shops that were unable to provide a plug point were given a battery-powered device instead. Neutral but bright colours were selected for the buttons, to avoid negative colour-emotion associations (e.g. green being good, red being bad). The questions and smiley faces were created using a label printer with white on black tape.

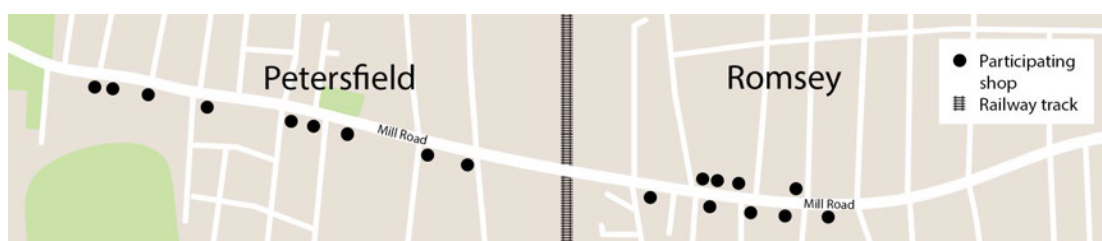
#### 4.2.4 Choice of input location

Together with the community groups it was decided that the voting devices would be placed inside the shops along the street. The residents strongly believed that these shops act as social hubs. One local community group organiser expressed it as follows: “*I believe the shops are the social glue of the Mill Road community*”. The inclusion of the shops was therefore seen as a key step in getting residents involved. Based on suggestions from the community groups, the council representative, and the local trade organisation, a list was made of ‘shops to approach’.

Petersfield		Romsey	
1	Charity shop	1	Charity shop
2	Charity shop	2	Flower shop
3	Local supermarket	3	Local supermarket
4	Liquor shop	4	Greengrocers
5	Café	5	Café
6	Takeaway	6	Café
7	Electronics shop	7	Café
8	Computer shop	8	Homeware
9	Oriental supermarket	9	Delicatessen shop

**Table 4.1:** Overview of participating shops

To ensure people from a variety of backgrounds would be able to encounter the voting devices, a range of different types of shops was selected. Using knowledge from the residents, shops were approached that appeal to diverse demographics, including cafes popular with young adults, shops popular with the elderly, and so forth. In addition, an attempt was made at selecting comparable shops on both sides of the railway bridge (see Table 4.1). Where possible, the same type of shop was approached, such as a charity shop, local supermarket and cafe on both ends. Whenever this was not an option, shops with a similar number of customers were selected. In total, 23 shops were approached along Mill Road. Of these, 18 agreed to participate (see Figure 4.5). Shopkeepers of the participating shops were given an explanatory leaflet about the project and were told the voting devices would be placed on their countertop with the aim of collecting opinions from the community. In addition, they were asked to provide suggestions for questions they would like to pose via the devices.



**Figure 4.5:** Map depicting participating shops

#### 4.2.5 Visualisation design

To make the visualisations accessible to a broad range of community members, the decision was made to use simple representations. The aim of these representations was to make it obvious that the visualisations conveyed something about the community, and the collected

votes, rather than only being an art installation. In addition, the visualisations were designed to provoke members of the community to reflect on their meaning, and to provoke further discussion about the perceived social divide on Mill Road. The public visualisations were designed to be placed in front of the participating shops along the street, on both sides of the railway track, in a way that would catch people's attention as they walked up and down the street. By displaying them on the pavement, at floor level, the design ensured that people would have to walk over or past them while moving through the street and visiting shops.

The specific placement of the visualisation, right in front of each participating shop, revealed from which shop or café the data was collected. In addition, to ensure that the data did not compromise people or shops, the decision was made to only visualise relative data, which allowed for comparison between visualisations without revealing sensitive data about the popularity of shops.



**Figure 4.6:** A set of initial sketches of visualisation ideas

A series of sketches were created (see Figure 4.6) and informally evaluated with three researchers working at University College London, to find out if the representations were easy to understand. The initial idea was to design visualisations that emerged from the participating shops in an organic manner, for example in the shape of flowers. This concept was inspired by Indian rangoli art, where rice, sand, or flower petals are used to create patterns on living room floors and in courtyards. However, this more elaborate representation affected the simplicity and readability of the visualisation. Furthermore, during the sketching phase it emerged that making use of the road would cause significant delays, as not only the city council but also the national Highways Agency would have to approve it. When it became clear such approval would involve closing off the road and taking out insurance policies for all people involved, it was decided that using the pavement would be a more realistic alterna-

tive. The size limitations this brought with it meant that the more elaborate, but less legible, flower ideas were replaced in favour of a more simplistic design.



**Figure 4.7:** Sketch of the visualisation of votes cast within a participating shop, with each figure representing 10% of the votes.

An Isotype-inspired visualisation, consisting of rows of ten human-like figures, was finally created and informally discussed with members of the community groups to ascertain readability and clarity. For each question posed via the voting device, a row was added, with each figure representing 10% of the votes. Percentages were rounded to ‘whole figures’ (e.g. 0%, 10%, 20%, etc.). These figures were coloured in, matching the colours used for the buttons on the voting device (yellow, white, and blue, representing happy, neutral, and sad). In addition, a keyword summarising each question’s theme was added at the front of the row (see Figure 4.7). This more ambiguous description was chosen to minimise clutter and encourage interaction between residents and shopkeepers to discuss the meaning behind each word. The visualisation was meant to convey enough information about the question and accompanying votes but also to encourage people to visit the corresponding shop to find out more about its meaning and the origin of the data.

The visualisation was stencilled on the pavement through the use of brightly coloured non-permanent chalk spray. This method of presentation was previously demonstrated to successfully communicate energy consumption data in the Tidy Street project (Bird and Rogers, 2010; Webb, 2011). The aim was to attract people’s attention while walking into shops or cafés while not being offensive or appearing as art or vandalism. Another benefit of using





**Figure 4.8:** Sketch of the summary visualisation, with bubbles comparing the aggregated percentage of happy votes in Petersfield and Romsey

chalk in this way is that wind and rain cause the chalk to slowly fade, thereby creating a natural way of ending the project. Besides providing a gradual ending, the use of chalk also pacified shop owners and employees of the city council, as they trusted all visualisations would automatically disappear over time. The visualisations were created using laser cut polyester stencils.

A final comparative visualisation was created on the bridge to allow for comparison between the Petersfield and Romsey area as a whole. For this visualisation, the data from the shops on the different ends of the street was aggregated, and shown as a bubble chart (see Figure 4.8). This visualisation was also discussed with members of local community groups, to ensure it was easy to interpret. To avoid compromising people or shops, only relative data was shown. Furthermore, the decision was made to only show data relating to the positive (happy smiley) votes, thus focusing on the positivity from both sides of Mill Road. This choice was primarily made to simplify the representation: showing the results from all three voting options for all questions for both Petersfield and Romsey would have resulted in a more visually complex visualisation. The focus on positive votes allowed the use of fewer, but larger and more eye-catching visual elements, thereby taking full advantage of the wider pavement on the railway bridge.

#### 4.2.6 Choice of visualisation location

The visualisations were positioned outside the participating shops, at all 18 different locations. The pavement in front of these shops was used as a canvas, allowing passers-by to read and compare the latest data. A distributed visualisation approach was adopted to complement the distributed input technology – designed to encourage people to walk along the

street to view the local results. Permission for the public visualisations was sought from the local council beforehand, to ensure the chalk graffiti would not be removed by street cleaners. All participating shopkeepers agreed to have the results displayed on the pavement outside their shops.

The summary visualisation was positioned on the railway bridge that connects Petersfield and Romsey, to allow the people on both ends of the street to easily view the results, while also encouraging people to explore Mill Road beyond ‘their’ side by motivating them to walk further.

### **4.3 In-the-wild study design**

The voting devices, together with a small explanatory poster, were deployed in 18 different shops along Mill Road. All devices were placed on the shop counters with the idea that the period of waiting that often takes place before customers pay and leave the shop would provide an opportunity to quickly voice their opinion. Shopkeepers were asked to decide upon the exact location of the device on the counter, informed by their knowledge of customer behaviour.

The devices were deployed for 24 days, from 21 August until 13 September 2013, to allow sufficient time for each question to be posed and discussed. This also gave the shopkeepers time to suggest additional questions based on feedback from their customers or their own ideas. In addition, it allowed for a gradual build up of the visualisations, which were updated after each question, and for news about the project to spread. The duration of the deployment was not fixed from the start, and was based on the number of question suggestions from shopkeepers and residents. When no additional themes or questions were suggested, the end date of the project was determined and communicated to all shopkeepers.

During the first two weeks, the questions on the devices were changed every other day and the data from the previous question was collected from the SD cards inside the devices. This process was done at the end of the afternoon, to coincide with the closing time of the majority of the shops. Shopkeepers were asked to only vote once a day themselves. They were also informed that they did not have to encourage customers to vote, but that they were free to do so if they would like to. Furthermore, the shopkeepers were told that they were not in any way responsible for the safekeeping or use of the voting devices. The visualisations



**Figure 4.9:** Left: voting device placed on till of participating shop. Right: visualisation on pavement

outside the shops were sprayed onto the pavement on alternating days, by a team of four local artists accompanied by the researchers. This was done at dawn, when all businesses were still closed and there was little traffic. The comparison visualisation on the railway bridge was created after the data from the seventh question was collected.

During the study the following data was collected using a mixed methods approach: (i) logged votes from the voting devices; (ii) observations in situ, inside the shops as well as outside, near the shop and bridge visualisations throughout the deployment; (iii) brief semi-structured interviews were conducted with shopkeepers and customers when the shops were visited to replace the question and to collect the data from the voting device; (iv) additional more extensive semi-structured interviews were conducted with shopkeepers at the end of the study. A total of 43 semi-structured interviews were carried out with shopkeepers (23 from Romsey, 20 from Petersfield) and 22 with customers and passers-by (12 from Romsey, 10 from Petersfield). To identify reoccurring themes, a thematic analysis (Braun and Clarke, 2006) was conducted on the collected qualitative data.

## 4.4 Findings

Throughout the deployment the distributed voting devices and public visualisations attracted attention in the Mill Road area and a total of 11,610 votes were cast at the participating shops. The pervasive visualisations lured people into shops, many of whom were observed asking the shopkeepers what was going on. Once aware of the project, some people returned regularly to answer the different questions and to view and compare results. Some even ventured across the bridge to find out more about the results ‘on the other side’. Furthermore, both inside the participating shops, and outside near the visualised results, the

project sparked conversations on the various topics addressed via the posed questions – including topics not usually spoken about. From the observations and interviews, it emerged that the study opened up discourse on previously ‘hidden’ topics. In the following sections these findings will be described in more detail, starting with an analysis of the types of engagement the project elicited, followed by a description of the voting behaviour.

#### 4.4.1 Curiosity

From the moment the voting devices were deployed and the visualisations started appearing on the pavement, people became curious about what was happening. The observations revealed that the majority of people walking down the street noticed the visualisations, as evidenced by their glances, and many stopped to have a look. Shopkeepers also started noticing passers-by coming into their shop specifically to ask questions about the project. *“As the little stick people started appearing, I think people got more interested in finding out what was actually happening”*, according to a volunteer at shop R1. Several shopkeepers commented on the benefits they believed this had for them, including the shopkeeper at shop R1: *“I think it is probably actually beneficial to us, because people are curious, they see the little stick people and because we are one of the shops that has a box [i.e. voting device] they come in. And then they may buy something.”* The potential commercial benefits were also brought up by the owner of shop P9: *“Those people passing by, they stop and have a look, it’s an advantage, they look into the shop as well. It’s a win-win situation [for the shop and the project]”*. Passers-by and local residents also started explaining the visualisations to one another. This behaviour was observed by the researchers in front of several participating shops. The owner of shop R2 noted: *“There is always someone out there explaining it to someone else”*.

Similarly, the colourful buttons on the voting devices were found to catch the attention of people inside shops. Although reactions to the voting devices were mostly positive, two types of initial wariness towards the technology were observed. The first occurred at shop R3, one of the shops that is open until late in the evening. Two different customers inquired whether the voting devices were placed in the shop by the police. According to the shopkeeper the customers made this association because the shop is known for selling alcohol, and on rare occasions the police has had to intervene when people caused trouble due to excessive alcohol consumption. However, upon seeing the explanatory poster and hearing more about the project from the shopkeeper, both customers cast their votes. The second concern



**Figure 4.10:** Passers-by looking at and discussing the visualisations sprayed on the doorstep of the participating shops

was related to the function of the voting devices. A handful of people who had voted but were not convinced the voting device actually stored their vote. To convince these sceptical customers, at least two shopkeepers opened the device to show the technology (as one the shopkeeper of R6 put it: *“I had to show them the wires!”*). Similarly, some people were hesitant to vote as they were wary of what the device might do: *“They seem a bit worried about pressing the buttons. They think they might get an electric shock, or something might explode”* [R9]. Another shopkeeper added: *“It seems to be the strange English temperament of people being a bit fearful of pushing buttons, and thinking somehow it is going to defraud them or something ridiculous like that”* [P4].

A number of shopkeepers took an active role in encouraging curiosity, by ensuring their customers would see the voting device. In one shop [R6], this meant the owner placed the voting device at an angle to increase visibility, in another shop [R7] the owner used her battery operated voting device to regularly approach all customers at the different tables in her cafe.

Furthermore, the local media and social media also played an important role in raising awareness of the project, and as a result fostering curiosity about it in the wider Cambridge area.

During the deployment, the project was featured in local radio shows and newspapers. Via Facebook and Twitter, people discussed the results and shared photos of the visualisations. This media activity directly impacted participation. For example, after a front page publication in the city's newspaper, shopkeepers noticed an increase in people coming into their shops, asking if they could cast their vote. One shopkeeper explained: *"It is getting to be known that this thing is going on. People realise that something is happening, and they are curious about it"* [R1].

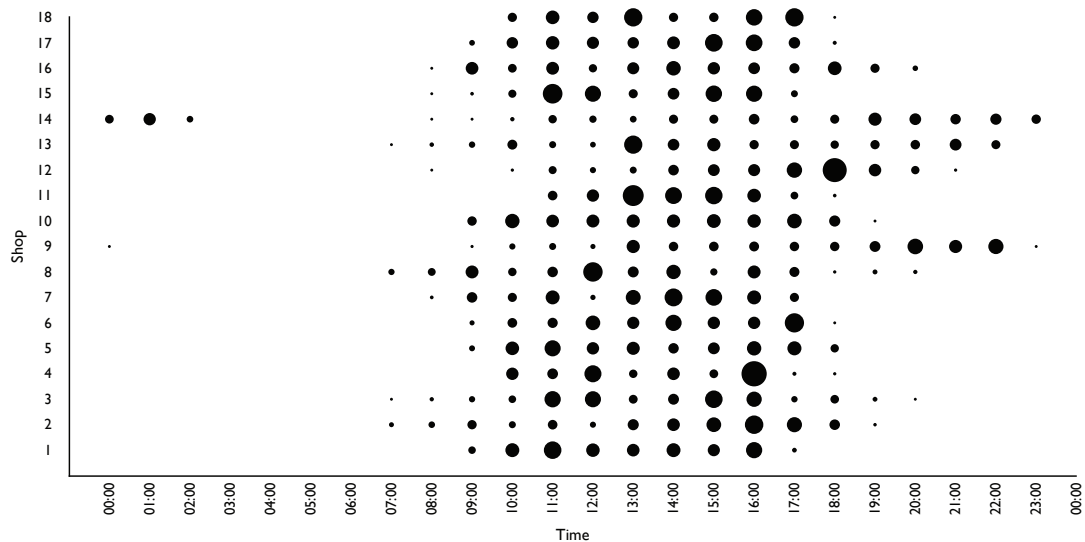
Towards the end of the study, when the summary visualisation was sprayed onto the railway bridge that connects the two parts of Mill Road, the initial response to this was far less noticeable. From informal conversations with customers, shopkeepers and passers-by, it emerged that many people had heard of the visualisation and the final results through word of mouth — but had not yet seen it themselves. All indicated they would visit it later that day or week, an action that often seemed to require conscious planning. The stark difference in the level of response towards the shop visualisation and bridge summary visualisation suggested people were still resistant to walk to or across the bridge from both ends. While the bridge is one of the few places that is visited by both sides of the street, few people cross it regularly, and as a result few people were found to visit the summary visualisations.

#### 4.4.2 Contributions

In total, 11,610 votes were cast during the deployment. The observations revealed that people typically submitted their own votes, but several collaborative sessions were also observed — including a mother who allowed her young son to vote on her behalf, explaining to him what to do. From the collected data, all obvious repeat votes were discarded, and only presses separated by a time interval of more than four seconds were considered to be unique votes (4879, i.e. 49%). This four second interval was chosen after tests on a sample of the data, and proved to filter out all obvious repeat votes (for example, instances of someone pressing the 'sad' button for minutes on end). Some of these repeat votes were observed to have been cast by children. However, the observations and semi-structured interviews revealed why also adults decided to vote more than once. In several cases, customers decided to cast multiple votes out of enthusiasm or conviction (e.g. *"You know the question "How well do you know your neighbours"? One family particularly said "We love our neighbours!" and he must have pressed it ten times"* [R8]). In addition, some customers voted multiple times because they

had changed their mind about their initial answer (e.g. “*There was a lady here who pressed it, and then after a while her mood changed – so she pressed it again*” [R6]). From the interviews it also emerged that a small number of people consciously voted differently for the same question in different shops and areas, to express that they perceived differences between two or more locations.

On average, 203 votes were cast per day. The number of presses peaked during the second day of the deployment, with 388 unique presses. As to be expected, a relatively low number of votes was cast on Sundays and Mondays, when most of the shops were closed, especially compared to Thursdays, Fridays and Saturdays. Overall, the majority of button presses occurred during the daytime, particularly between 11:00 and 18:00 (see Figure 4.11).



**Figure 4.11:** Voting density per hour per shop proportional to total votes per shop, showing varying peak times

The number of votes differed greatly between shops, as shown in Table 4.2. Relatively few votes were cast in small shops, and shops with irregular opening times. Local supermarkets and other shops with long opening hours received far more votes than any other shops. However, in addition to receiving many unique votes, supermarkets and shops that were open in the evening hours also attracted most repeat votes. For example, the shop with the longest opening hours (09:00 – 00:00 every day of the week) had a total of 2766 votes, of which only 500 were classified as unique (18.1%). Two of the shopkeepers who manage these popular premises brought up that this may be linked to the fact that all the shops with



evening opening hours sell alcohol, suggesting there may be a link between repeat votes and alcohol consumption.

The first question, which addressed happiness, received most votes (999). The fewest votes (371) were submitted during the sixth question, which was focused on street buzz (see Table 4.2). On average, 542 votes were cast per question. The type of votes also differed slightly per area, with relatively more ‘happy’ votes being cast in the Romsey area for each question (as shown in Figure 4.12).

One shopkeeper expressed concerns about the quality of the contributions, as he believed not all of his customers were thinking about the questions and statements before casting their votes: *“I know this is none of my business, but the statistics you are collecting is completely wrong – people just do something [random]. They come here, with their own thoughts, and they just press something. What you think you are measuring is not what you are measuring.”* [P8].

A few minor interruptions in the data collection occurred over the course of the deployment, which may have affected the number of contributions: three shopkeepers accidentally disconnected their voting devices from the mains power. Similarly, the battery-run devices occasionally ran out of charge earlier than anticipated, resulting in the loss of a few hours of data. Also unexpected were the irregular opening times of a handful of shops, which were closed whenever there was a shortage of personnel — sometimes for several days.

#### 4.4.3 Revisitation

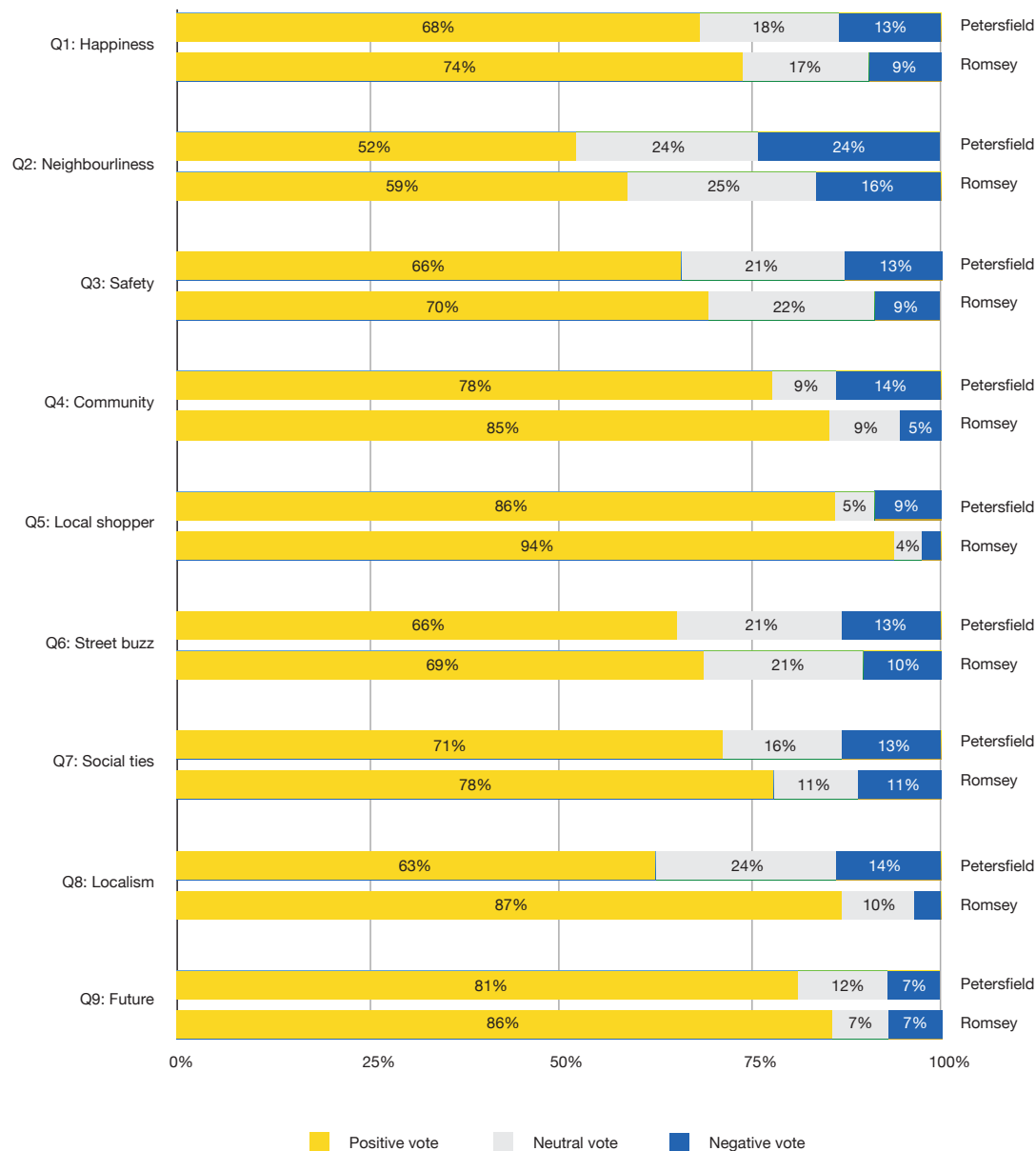
Interest in the questions and visualisations remained high throughout the deployment, with even those already familiar with the project returning to vote and view the updates regularly. One shopkeeper recalled how several people came in without purchasing anything: *“they’ve literally run in, said “what’s the question?”, answered it and gone again”* [R2].

During interviews with passers-by it emerged many people had been casting their vote on a daily basis once they found out about the project (e.g. *“I spotted the boxes, and I have been pressing every day”*). Others, who did not specifically plan visits to the shops in order to participate, still regularly came across the devices while visiting shops as part of their weekly routine. For example, the greengrocers, delicatessen shop, and liquor shop had many customers who visited on a weekly basis, and thus participated once a week.



	Question									Total
	Q1: Happiness	Q2: Neighbourliness	Q3: Safety	Q4: Community	Q5: Local shopping	Q6: Street buzz	Q7: Social ties	Q8: Localism	Q9: Future	
Days	3	2	2	2	2	2	2	3	6	24
Petersfield shop 1	30	15	16	0	24	13	16	17	27	158
Petersfield shop 2	11	5	1	6	19	2	8	12	18	82
Petersfield shop 3	42	31	25	21	16	25	19	25	58	262
Petersfield shop 4	90	14	23	31	37	0	35	40	43	313
Petersfield shop 5	162	76	49	62	73	66	12	0	0	500
Petersfield shop 6	90	23	35	27	38	10	20	2	0	245
Petersfield shop 7	29	8	7	12	52	8	3	34	41	194
Petersfield shop 8	23	2	2	10	12	2	14	13	35	113
Petersfield shop 9	64	40	30	43	35	19	27	18	66	342
Petersfield total	541	214	188	212	306	145	154	161	288	2209
Romsey shop 1	177	85	78	110	133	52	99	88	102	924
Romsey shop 2	81	72	24	79	35	55	32	31	0	409
Romsey shop 3	13	13	9	7	15	3	7	0	0	67
Romsey shop 4	57	11	17	22	37	14	26	39	55	278
Romsey shop 5	23	14	13	27	25	19	25	20	32	198
Romsey shop 6	20	14	2	6	12	17	6	11	20	108
Romsey shop 7	57	27	30	42	31	25	28	42	102	384
Romsey shop 8	16	38	33	21	40	24	24	0	0	196
Romsey shop 9	14	8	14	8	14	17	7	0	24	106
Romsey total	458	282	220	322	342	226	254	231	335	2670
Total	999	496	408	534	648	371	408	392	623	4879
Avg. per day	333	248	204	267	324	186	204	131	104	203

**Table 4.2:** Overview of votes per shop



**Figure 4.12:** Comparison of votes per question per area

#### 4.4.4 Reflection

From the interviews with passers-by, customers, and shopkeepers, it emerged that the questions and results from the Visualising Mill Road project had made them contemplate a) their views and what these views are based on, and b) changes on Mill Road over the years, as evidenced by their comments to the shopkeepers, and the interviews with the researcher. The latter was mainly the case for people who have been living in the area for a long period of time, with many reflecting on their youth (e.g. *“Mill Road has changed a lot in terms of the kind of feel of the place. When I was kind of around 16, 17, 18, it was always seen as a really dodgy area*

*and over time it has become much more sort of multi-cultural and therefore a more accepting area.*" [P4]; *"They used to warn you, you must not go down to Romsey, it is a very rough area. I don't think that's true now."* [P7]). Similarly, by thinking about the responses to the different topics, some shopkeepers realised that the strong feelings about the divide were less prevalent amongst younger people. A shopkeeper from shop R8 explained: *"I think it is a generation thing [to perceive this divide]. Youngsters, they are all right [i.e. they do not mind crossing the bridge]."*

Reflections on the questions and results also made some people consider their own views (e.g. *"Maybe it is just a feeling [that she finds the other side of the road unsafer], I don't know."* [R7]; *"I don't know if [my view on the divide between the two areas] is perception or reality"* [R4]; *"One or two people, in pressing the button, were suddenly questioning themselves, as to how they should answer – and therefore, you posed a question to them, which up to that moment, they did not seem to have considered"* [R1]).

#### 4.4.5 Discourse

During the observations it became clear that the questions displayed on the devices led to many discussions between customers and shopkeepers, resulting in the formation of multiple honeypots (Brignull and Rogers, 2003) along the street. For example, in shops P2, P7, R3, R7 and R9, it was observed that customers started sharing anecdotes of unsafe situations that they had experienced or heard of on Mill Road. The ambiguity of the questions also resulted in additional discussions. In shop R9, a customer asked the shopkeeper *"What kind of safety would they mean? Traffic or something else?"*, which was then followed by a conversation on the different types of unsafe situations on Mill Road. In the semi-structured interviews the occurrence of these discussions was further confirmed by shopkeepers: *"You have got everyone talking about it!"* [R9]; *"It has encouraged people to talk about their environment"*; *"It has definitely made people talk about issues, like community, safety, general trendiness of Mill Road itself. Most people wouldn't bat an eyelid, normally"* [R8]; *"It has been a really good talking point"* [P4].

The shopkeepers indicated that the question on safety led to most discussion (e.g. *"Safety, as in, muggings, robberies, [were talked about] more than anything [else]"* [P4], *"The safety one had a lot of people talking"* [R7]). Several shopkeepers explained that this was likely because of the nuisance caused by excessive alcohol consumption and drug abuse in the area, issues that are in stark contrast with the shopping and community friendly image Mill Road is known for. The shopkeeper of shop P4 explained this juxtaposition: *"I look out of the window and see drug dealers and drunks and not great people, but then most people have got a really positive feel about them."*

*And then you've got really expensive houses around the corner and you have got this kind of weird play-off between [the area being] quite dodgy at night, yet [there are] families and middle class people who own 700,000 pound houses."*

The second most discussed topic was neighbourliness, which provoked discussions on the changes Mill Road has undergone over the last decades – in particular because of the influx of students in the area. One shopkeeper explained: *"Some people know their neighbours really well, but [others] feel sometimes maybe it's hard to get people involved in community things, because there's such a large student population around here. [...] Every year there's different people leaving and different people coming in."* [R2]

Throughout the study, reactions to the project were also communicated via social media. In Facebook posts, Tweets and blog posts, people drew attention to the project and voiced their opinions. While some of these were in response to press coverage the project had generated (one person retweeted the URL to one such article, adding *"I♥ROMSEY"*), others were more general reflections on the area (*"It has been interesting to see how this area has changed since I was a youngster"*) or the visualisations (*"It's official according to the graffiti on Mill Road railway bridge, Romsey residents are happier than Petersfield ones"*).

The voting devices and visualisations appeared to generate different types of discussion. Whereas the conversations held inside the shops largely focused on personal perceptions and the sharing of anecdotes, the conversations around the visualisations leaned towards comparisons with others. For example, comparison of personal perceptions versus those of the other customers of that shop, as well as comparisons between shops and areas. In many ways, the visualisations provided people with evidence to vindicate or refute their individual prejudices, and as a result reactions to the visualisations were often focused on either agreement (e.g. *"[nods while looking at results] we are the safer side"*) or surprise (e.g. *"I am surprised neighbourliness did not score more positive, this is a very friendly area"*). The overall impression of the voting results sparked most debate: the area that is historically seen as poorer and more unsafe (Romsey) had voted more positively for all questions. This was highly surprising to many.

#### 4.4.6 Comparison

The situated visualisations successfully supported three types of comparison: between questions, between shops, and between areas. The use of relative data, rounded to tens, allowed



**Figure 4.13:** Passers-by looking at the visualisation on the railway bridge, representing the differences in votes between Petersfield and Romsey

people to easily compare and remember results between different locations (e.g. a local residents said “I was really interested to see that at [shop] there’s a 100% neighbourliness. You know, 10 little men, in yellow. Whereas some of the other places, quite nearby, are not saying that. Like the [shop] just here, I think there is only one or two for neighbourliness”). This encouraged a number of people to visit ‘the other end of the street’, to see how the results there compared to those on ‘their’ side (“The good thing is that there are very few blues, wherever you are, one or two blue men, whatever question, so that’s good. Some, not at all.”).

News about the differences between the Petersfield and Romsey spread rapidly, with people on both ends sharing their findings, and the latest hearsay, in gossip-like conversations in the different shops and cafes (e.g. “I have heard some rumours that it is more positive on the other side of the bridge [Romsey] than it is from over here. [...] Really surprising, because people seem to be more kinda positive on this side of the bridge” [P4]). The unexpected outcome, with people in Romsey having voted more positively on all questions, fuelled speculation (“Maybe everyone gets positive here and then moves to that side of the bridge [and votes there]?”), as well as pride (“We are the best side” [R6]; “Good. That disproved the local theory then, doesn’t it?” [R7]).

#### 4.4.7 Competition

The ability to vote in different locations and compare results also promoted a sense of competition. This feeling of competition was present on a shop-level (e.g. a shopkeeper was observed asking a customer to please vote positively, as they had *“so many blue people outside already”* [R8]. The customer did not comply, but others potentially did) as well as on an area-level (e.g. *‘A lot of my customers have been quite possessive about insisting “this is the happy side, this is the strong community side”’* [R6]).

By voting multiple times, both customers and some shopkeepers attempted to influence the results. While most shopkeepers explicitly said they did not vote themselves and instead focused on getting customers to vote, two admitted to casting repeat votes (*“The first time I saw it I had a bit of a symphony [on the buttons]. But yeah, I’ve been a good boy [since then]”* [P8], *“Sometimes I might press it twice, between you and me”* [R6]).

### 4.5 Discussion

The main objective of this case study was to examine how a highly situated urban visualisation intervention, with a clear coupling between input and output, could encourage engagement with themes identified by the local community. The following five research questions addressed this in more detail:

#### VMR RQ1: **How does the use of community-generated topics affect engagement?**

By sourcing topics from people in the local community, including members of community groups, shopkeepers, and residents, a set of accessible questions and statements could be formulated – relevant to both locals and visitors. During the deployment, all observed and interviewed participants were found to be able to understand and answer the posed questions and statements with ease. In addition, the topics were found to motivate discourse around different local issues, including safety in the area. Furthermore, the use of multiple topics meant that the posed questions and statements were replaced regularly, which was found to create a feeling of suspense and anticipation – with people looking forward to these updates and specifically visiting the devices in order to see the latest topic. While the process of involving the local community in identifying topics is likely to require a considerable investment of time, the approach ensures that the themes will be more topical, and thereby

more likely to foster engagement. In contrast, such levels of engagement are typically more difficult to achieve when external project initiators, like researchers, determine the topics, as their limited knowledge of local affairs often results in the use of generic topics that are not location specific.

**VMR RQ2: How does the use of voting affect engagement and contribution quality?**

The use of voting as an input method provided a clear interaction mechanism, which was found to be readily understood by all participants. The familiar design of the simple physical voting devices, with three tangible colourful buttons, was found to evoke participation from people from different backgrounds and ages. A limitation of the use of such simple voting technology, however, is that it also enables people to vote more than once, as also found by Taylor et al. (2012) and Vlachokyriakos et al. (2014). The findings from this study showed that while it is possible to identify such repeat votes, the criteria for removing false positives (e.g. people voting in quick succession) and false negatives (e.g. ‘slow’ repeat votes from one individual) require further development. Alternatively, more advanced solutions can be used to identify all participants and avoid repeat voting, such as RFID-enabled transport passes (e.g. Behrens et al. (2014)) or mobile phones (e.g. Schroeter (2012)). However, while this can ensure a higher quality of contributions, it has previously also been found to limit participation as not everyone possesses these technologies and as a result may not be able to take part. This highlights a trade-off between the inclusivity of an input mechanism and the quality of the data it can collect.

**VMR RQ3: How does the distribution of input technology affect engagement?**

The distribution of the voting devices throughout the neighbourhood was intended to engage people living, working, and shopping in different areas – thereby reaching a wide diversity of people. The findings showed that the distribution successfully supported engagement throughout the area. Key to the community-wide participation, however, was the integration of the technology into the rhythms and routines of the community. The contexts in which the devices were located, shops, were found to be particularly important, as people in the area had pre-existing relationships with these environments and the people working in these environments. Involving shopkeepers by placing the voting devices in their shops

ensured that the technology was embedded in the existing community practices. Furthermore, it enabled the shopkeepers to act as community champions, explaining the purpose of the intervention to people and sometimes actively encouraging community members to participate.

#### VMR RQ4: **How does the distribution of visualisations affect engagement?**

By distributing the visualisations throughout the neighbourhood, in the same locations as the voting devices, the aim was to create a clear coupling between input and output. The study showed that this approach was successful, as it encouraged people to visit the shops to ask shopkeepers about the meaning behind the representations outside – where they would then find the voting devices. The distribution also ensured that over the course of the deployment many people came across the intervention. This was in particular because of the visualisations' eye-catching positioning on the pavement which proved key in getting people to notice the installation. In addition, the distribution of visualisations enabled people to compare the data collected in the participating shops by walking from shop to shop, which was found to encourage people to interpret, discuss, and compare the results.

#### VMR RQ5: **How do delayed visualisation updates affect engagement?**

By delaying the updating process of the visualisations, the aim was to evoke curiosity. The findings showed that this technique worked as intended, with people anticipating the arrival of new data, and visiting the visualisations in order to see updates. The regular, fixed updating moments helped foster this engagement, as, over time, people were found to get an understanding of when they could expect new content. These findings demonstrate that while current technology enables the presentation of real-time data, a slower approach can be valuable too – in particular when attempting to engage people over time.

### 4.5.1 **Types of engagement**

The study showed that people went through different stages of engagement with the input technology and visualisations. From the observations and interviews, four distinct stages of engagement were identified, of which an overview is shown in Figure 4.14.

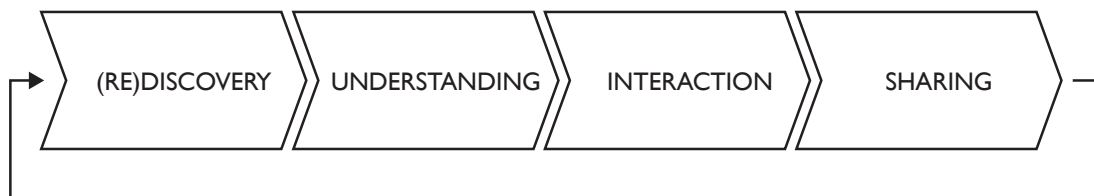
In the *discovery stage*, people **notice** either the input technology or visualisation. They then **approach** the installation, with the intention of finding out more about it. In the *understand-*





**Figure 4.14:** Stages of engagement with the input and output

*ing stage*, people **read** the displayed information, such as the posed question and the visualised data, to get an understanding of both the objective of the installation and the manner in which it has been appropriated by the community through usage. During this phase, they **reflect** on their own perceptions, **compare** the available information, and **question** people nearby about the aim of the installation or the topic it addresses. In the *interaction stage*, people submit data (e.g. by casting their vote) or otherwise directly **interact** with the installation. In the *sharing stage*, people **discuss** aspects related to the installation with others (e.g. their personal opinion, the posed question, the visualised data, etc.). This sharing took place in the proximity of the installation and remotely – for example in different locations, or when people **publish** information about the intervention online. A key part of this sharing involves the act of **championing**, where people encourage others to participate.



**Figure 4.15:** A repeat of the stages of engagement occurs when people return to the installation

The study also revealed that the four stages are often repeated when people return to the installation at a later point in time. In this case, the discovery stage turns into a *rediscovery* stage – where people revisit the installation as a result of observed changes, such as a newly posed question, or newly visualised data.

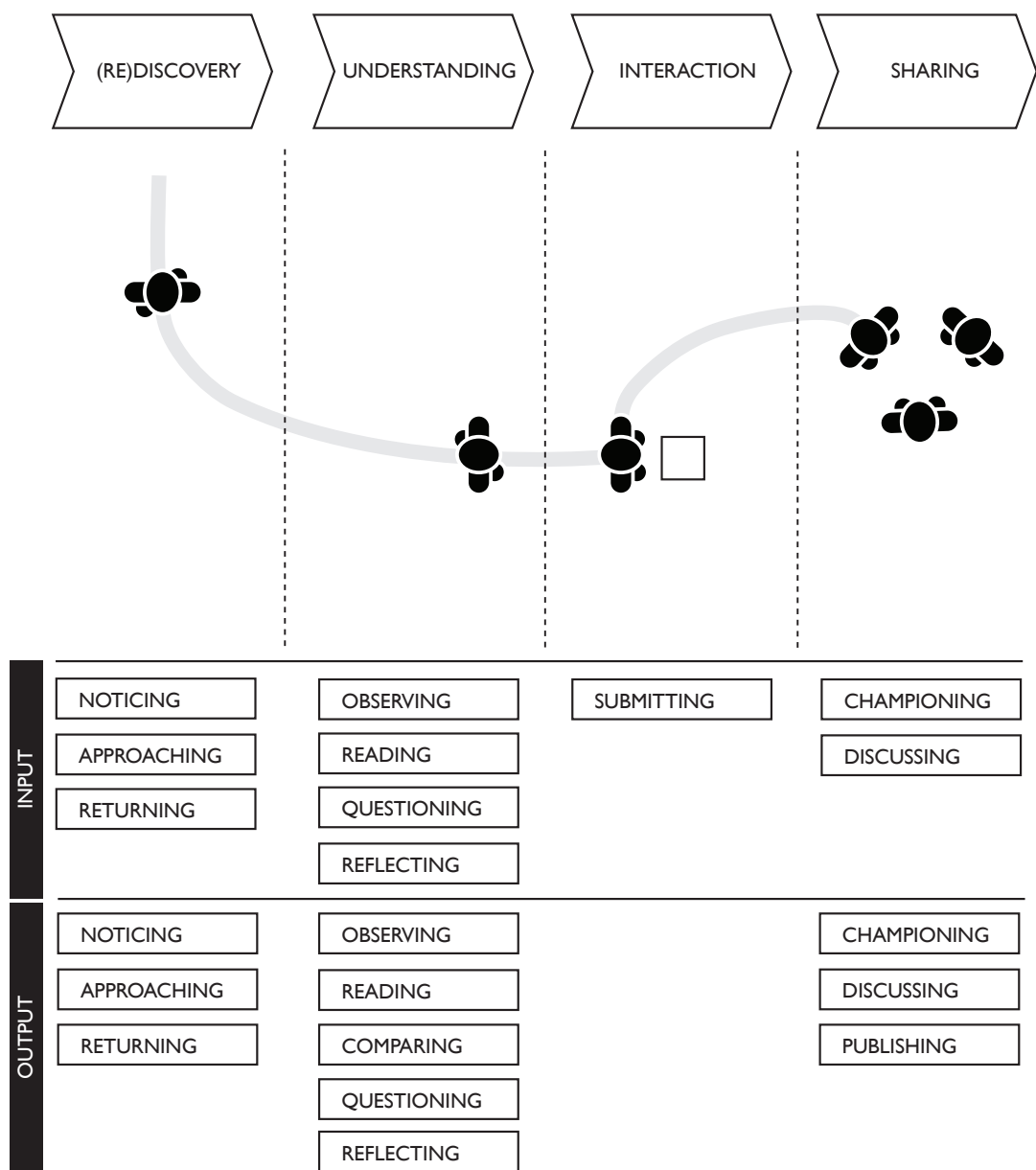
The identified stages of engagement describe the typical transition from passive engagement to active engagement that people were observed experiencing with the input technology and visualisations. The emphasis is specifically on the temporal progression between stages, rather than the spatial progression in the physical environment. In contrast, previous work

	Discovery	Understanding	Interaction	Sharing
Brignull and Rogers (2003)	1. Peripheral awareness activities	2. Focal awareness activities	3. Direct interaction activities	
Finke et al. (2008)	1. Enter 2. Glance	3. Decode 4. Observe	5. Input 6. Feedback 7. Results	
Fischer and Hornecker (2012)	Display space / Activation space	Display space / Activation space	Interaction space / Potential interaction space	Social Interaction Space
Memarovic et al. (2012b)	1. Passive engagement zone	2. Active engagement zone 3. Discovery		
Michelis and Müller (2011)	1. Passing by 2. Viewing and reaction	3. Subtle interaction	4. Direct interaction 5. Multiple interactions	6. Follow-up interactions
Streitz et al. (2003)	1. Ambient zone	2. Notification zone	3. Interactive zone	
Vogel and Balakrishnan (2004)	1. Ambient display	2. Implicit interaction 3. Subtle interaction	4. Personal interaction	

**Table 4.3:** Mapping of existing interaction frameworks onto the discovery, understanding, interaction, sharing model

has often focused on studying the relationship between engagement and people's proximity to the interactive installation. For example, Brignull and Rogers (2003) identify activity spaces around a public display, Streitz et al. (2003) distinguish three zones of interaction, and Vogel and Balakrishnan (2004) developed these further into four interaction phases. As these frameworks are generally aimed at describing and guiding the design and deployment of a single digital display, describing engagement in terms of proximity is appropriate. However, these frameworks do not directly translate to installations that consist of multiple elements. For example, the urban visualisation approach taken in this thesis, whereby input technology and public visualisations are co-located in the same area, but not necessarily in the exact same location, requires a more holistic view of the urban visualisation intervention as an ecosystem. The framework introduced in Figure 4.16 therefore describes people's engage-

ment with the overall installation (i.e. the whole ecosystem) as a series of behaviours over time. As shown in Table 4.3, a number of the activities and zones identified in frameworks with a spatial focus map directly onto these temporal stages. However, the key distinction is that the temporal stages are not restricted to the spatial setting. For example, the conversations that take place in the ‘understanding’ and ‘sharing’ phases can occur in-situ, online, or at locations that are physically removed from the physical installation.



**Figure 4.16:** Engagement framework: types of engagement with the input technology and output visualisations

The four stages describe the high level stages of engagement. During the Visualising Mill Road study, a variety of lower level types of engagement were identified, as shown in Figure 4.16.

In the discovery stage, people **noticed** the input device and / or visualisation. It has previously been shown that making people look at publicly situated displays is highly challenging due to display blindness (Müller et al., 2009). Even when people do look, glances are typically brief (Huang, 2007). As it is key for people to notice the installation in order for them to further engage with it, this part of the discovery stage was crucial for overall engagement. Next, many people **approached** the input device and / or visualisation. This involved walking to one of the visualisations on the pavement, and walking up to the shops' tills with the intention of getting a closer look – i.e. with the intention of moving on to the understanding stage. While some people approached the voting device or visualisation immediately after noticing the installation, others **returned** at a later point in time. Similarly, of those who did proceed to approach the installation and interact with it, some returned hours or days later to engage with it again. Such *rediscovery*, whereby people visit the installation multiple times, has previously also been observed in relation to publicly situated displays (e.g. Bedwell and Caruana (2012); Fortin et al. (2014b); Memarovic et al. (2013)).

In the understanding stage, people **observed** other people who were engaging with the voting devices in order to learn more about how the voting devices could be used, and the visualisations could be interpreted. Such 'learning by example' is frequently observed in deployments of public displays (e.g. Brignull and Rogers (2003); Dalsgaard and Halskov (2010); Finke et al. (2008); Memarovic et al. (2012b); Peltonen et al. (2008)). In addition, people **read** the question posed on the voting devices, and the information shown via the visualisations. Furthermore, people **questioned** shopkeepers, and occasionally passers-by, to find out more about the input devices and visualisations, asking them about its purpose and usage. The reading of the questions and visualised data, and conversations with shopkeepers and passers-by motivated people to **reflect** on their own perceptions of the topic at hand. People also **compared** the visualisations between shops, to learn more about how voting behaviour differed between shops and areas.

In the interaction stage, people **submitted** their votes via the input technology. This stage took place in close proximity to the installation, as it required direct interaction with the

installation. While many of these interactions were conducted by individuals, some also took place in collaboration with others. Such group interaction often also takes place around publicly situated technology (e.g. Memarovic et al. (2012b); O'Hara et al. (2008); Peltonen et al. (2008); Valkanova et al. (2014)).

In the sharing stage, people **discussed** what they learnt from reading the visualisations, their personal perspectives, and their predictions. This follows on from previous work that has shown how situated displays can successfully facilitate discourse in semi-public settings (e.g. Brignull and Rogers (2003); Rubegni et al. (2011)) as well as public settings (e.g. Steinberger et al. (2014); Valkanova et al. (2014)). Furthermore, people actively *championed* the installation by encouraging others to participate too – for example by pointing out the visualisations to them, directly asking them to submit their vote, or demonstrating how it works (Bedwell and Caruana, 2012). This act of championing has previously been observed around other publicly situated installations, such as displays (e.g. Akpan et al. (2013); Bedwell and Caruana (2012)), playful installations (e.g. Balestrini et al. (2016)), and voting devices (e.g. Taylor et al. (2013)). People also shared the project by **publishing** it via social media and traditional media. While social media has previously been employed by researchers to increase awareness of urban interventions (e.g. Laureyssens et al. (2014)), in the Visualising Mill Road study this type of online promotion was done independently by local media, residents, visitors, and shops.

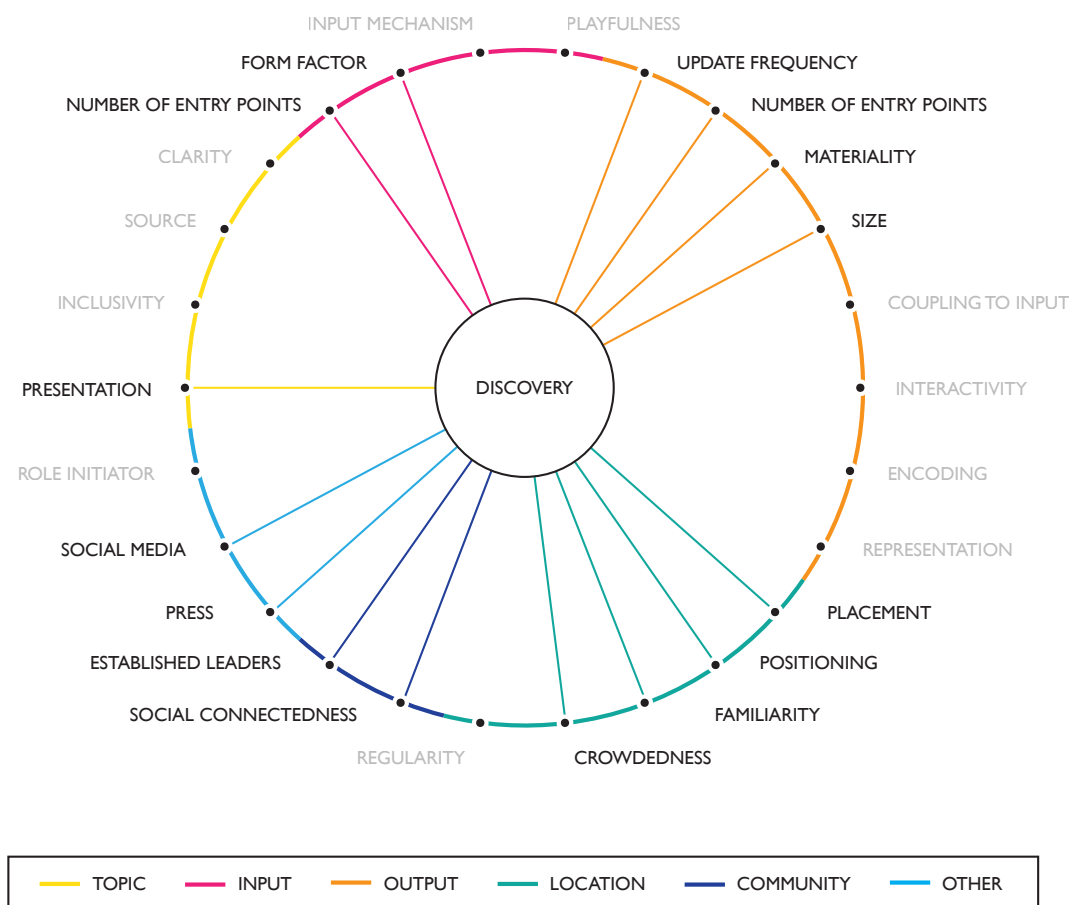
#### 4.5.2 Design and contextual factors

Several factors related to the design of the intervention and the context in which it was deployed were found to affect engagement. All factors were categorised in the following six categories:

- Design factors:
  - *Topic*, i.e. factors relating to the question / statement addressed by the installation
  - *Input*, i.e. factors relating to the selected input technology
  - *Output*, i.e. factors relating to the selected output display
- Contextual factors:
  - *Location*, i.e. factors relating to the physical deployment setting

- *Community*, i.e. factors relating to the social deployment setting
- *Other*, i.e. factors relating to alternative aspects of the deployment context

A visual overview of the factors was created to show which factors relate to which stages of engagement. At the end of each case study, this visual representation is used to map the role of all identified factors. Collectively, these overviews are used to develop a framework of factors, which is presented in the Discussion (Chapter 10). An example visual overview is shown in Figure 4.17.



**Figure 4.17:** Example visual overview of factors relating to (re)discovery

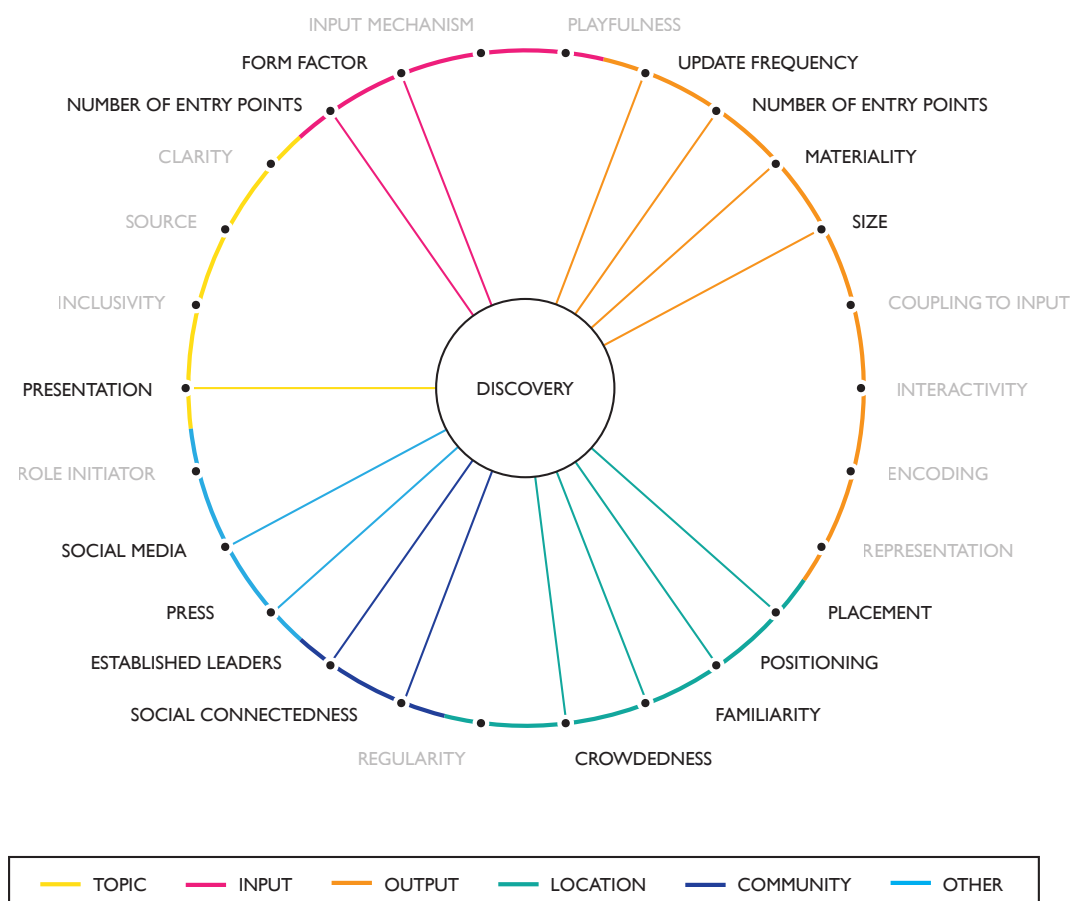
In the centre of the overview the engagement stage in question is displayed. On the overview's outer ring all design and contextual factors that were found to impact engagement in one or more of the case studies are listed. The factors are sorted and colour-coded by category, covering both factors relating to the design (topic, input, or output) and the context (location, community, and other). A legend at the bottom of the overview indicates in which category each factor falls, with the contextual factors being shown in dark colours.

Lines connect the individual factors to a specific stage of engagement, showing that a link was found between a factor and the stage of engagement. For example, in Figure 4.17 a line is shown between ‘number of entry points’ and ‘discovery’ to show that the number of input devices that was used was found to affect how many people discovered and approached the intervention.

How each of the identified factors influenced the four stages of engagement in the Visualising Mill Road study is outlined below.

#### 4.5.2.1 Discovery and rediscovery

Discovery of the input devices and visualisation was affected by several key factors, including the update frequency of questions, and the number of entry points for input as well as output, as shown in Figure 4.18. These factors are discussed in more detail below.



**Figure 4.18:** Factors framework: factors relating to (re)discovery

#### Presentation of topics

By regularly updating the questions, at fixed times, a rhythm was established that encour-

aged rediscovery. The frequency of updates enabled people to look forward to visiting the shops, and some people were even observed planning their visits in order to see the latest question. By updating regularly, but not instantly, a sense of anticipation was built. Initial investigations on designing for anticipation, using so-called ‘slow’ technology, have been conducted in home settings (Odom et al., 2014) and by studying non-instant digital messaging platforms (Hawkins et al., 2015; Tsai et al., 2015). This case study shows that the pacing of content in public settings can also successfully encourage revisitation. As people tend to visit shops regularly, but not necessarily on a daily basis, the update frequency of two days was a design decision deemed appropriate for a deployment in a high street. However, the pacing is likely highly context dependent, and may require more or fewer updates depending on the timespan of the intervention and how often the location is visited by people. If the location is unlikely to be revisited in the near future, the posing of multiple questions at once may prove more suitable.

### **Number of entry points for input**

By distributing a series of devices across multiple locations, the number of entry points (Hornecker et al., 2007) was increased. As a result, the likelihood of locals coming across them at some point while visiting the area was also increased. With the exception of a few studies (e.g. Taylor et al. (2012); Vlachokyriakos et al. (2014)), till date, deployments of public input technologies have largely focused on the use of a centralised approach, where a single entry point is placed in a key location. This approach is sufficient in areas that have such key locations, such as a popular public square or train station. However, a centralised approach is less suitable in residential neighbourhoods or other areas that do not have one clear ‘common place’ that is frequented by a large proportion of the local community. This case study has shown that a distributed approach can instead enable people to discover the technology at multiple locations.

### **Input technology form factor**

The physical presence of the voting devices in the community enabled locals to encounter them during their everyday routines. In other words, localised discovery was facilitated by the tangible design of the input technology. Furthermore, the overall look of the voting devices, consisting of brightly coloured arcade buttons against a black background, was found to catch people’s attention. The buttons were also found to attract people to the devices by



evoking curiosity: people were keen to find out what their function was. This confirms previous findings on enticing people to publicly situated technology by designing for curiosity (Houben and Weichel, 2013).

### **Update frequency of output**

Similar to the regular updating of the questions, the scheduled updates of the visualisations was found to encourage revisitation. By slowly unfolding the data over time, rather than revealing the data instantly, people gained awareness of the pace at which they could expect additional information. By delaying the updates, people had something to look forward to. As a result, the visualisation updates became anticipated events, motivating people to return regularly. Further research is required, however, to establish appropriate pacing for different contexts, and to find out more about how long ‘slow’ updates can motivate urban communities to stay engaged.

### **Number of entry points for output**

The distribution of visualisations along Mill Road ensured that there were entry points across the community, and that a large number of people took notice of them. This pervasive approach helped spread awareness of the project and fostered curiosity among residents and visitors who were keen to find out more about the meaning of the representations. Similar to the lack of distribution of input technology, till date, few studies have explored the use of decentralised situated output. Furthermore, the deployments that have made use of multiple entry points, such as the Viewpoint study (Taylor et al., 2012), have only explored small scale distribution (e.g. Viewpoint was deployed at three locations). This case study, where visualisations were shown at 19 different locations, has shown that a distributed output approach can enable discovery and revisitation across a community.

### **Materiality of output**

By adopting a non-digital display approach, using chalk graffiti, the project did not require the type of infrastructure that is typically needed for digital displays (e.g. electricity, Internet connection). The materiality of the visualisations made them far less constrained in where they could be deployed, which meant that the existing urban environment could act as the visualisations’ canvas. As a result, not only the input technology, but also the visualisations could be embedded in the community’s rhythms and routines – making them easy to discover

and revisit. In addition, the use of colourful chalk graffiti made the representations stand out against grey pavement, making people notice them.

### **Size of output**

The discovery of the visualisations was further encouraged by the size of the visualisations, which made them prominent features along the street, see also the Placement section below.

### **Placement**

Both the input devices and visualisations were placed in the context of local shops, either inside (voting) or just outside (visualisations). This placement was chosen because of the important social role these shops played in the area, according to local residents. This approach was particularly valuable because the area does not contain other key social spaces that are regularly visited by a majority of residents, such as a central square. As the shops were already part of the existing rhythms and routines of the community, embedding the project in these locations promoted discovery and rediscovery: people were known to visit these places regularly, and would inevitably stumble upon the project. This proved particularly key for the involvement of people beyond the core group of active community members, as these people were less likely to attend meetings by community or resident groups, but were likely to visit the shops. Furthermore, the diversity of the shops involved proved crucial for engaging a broad range of people. The findings suggest that for community-wide discovery it is key to leverage on the social role of existing public and semi-public places — such as shops, libraries, and stations. As these locations already play an important role in the community, their involvement can help kickstart participation from a wide variety of people.

### **Positioning**

In addition to selecting well-visited places, the positioning of the input devices and visualisations within these venues also emerged as a key factor in facilitating discovery. The positioning of the voting devices on the tills of the participating shops meant that the devices were embedded into existing community practices, as people were likely to notice them when paying for their goods.

Similarly, the positioning of the visualisations on the pavement adjacent to the entrance of each participating shops meant that people were likely to notice them when entering or leaving the shops. This visibility of the representations displayed on the pavement suggests

that further explorations of alternative display surfaces (i.e. not all digital upright screens) may help in finding ways to combat display blindness. Findings from the Mill Road study, and the earlier investigation of street graphs in the Tidy Street project (Webb, 2011), suggest that the use of the ground can be effective, especially as people naturally often look down while walking. It should, however, be noted that one reason for the success of this alternative display surface may be its novelty. If, at some point, pavements and streets are filled with information, a display blindness similar to that of current upright displays may develop.

The size of the visualisation in relation to the narrowness of the pavement also encouraged passers-by to walk close to, or over, the visualisations, further promoting discovery. This confirms recommendations for other types of publicly situated technology, which state the importance of positioning installations near traffic flows, such as the positioning of kiosk systems (Maguire, 1999) and digital displays (Brignull and Rogers, 2003).

### **Familiarity**

People's familiarity with the locations in which the input technologies and visualisations were placed proved important for discovery. The introduction of the novel devices and representations was noticed instantly by those highly familiar with the environment: their expectations of the familiar context were challenged.

### **Crowdedness**

In busy locations, such as one of Mill Road's takeaway shops, the honeypot effect was observed regularly. The presence of people around the voting device or visualisations intrigued other passers-by, who then walked up to them to find out why people were standing there.

### **Social connectedness**

The pre-existing social connectedness within the Mill Road community ensured that word spread quickly about the project: customers spoke to shopkeepers, active residents spoke to other people attending community group meetings, etc.

### **Established leaders**

The involvement of key figures in the community, including trusted long-term residents and shopkeepers, with whom the residents were already familiar, played a key role in spreading awareness of the project. For example, shopkeepers were observed telling customers about the voting devices when they approached the till. By leveraging the existing social role these

established leaders had within the Mill Road community, news about the project not only spread quickly, the leaders' support also gave the deployment credibility.

### **Press**

Traditional media played an important role in creating awareness of the project in the wider area. After mentions on a local radio show and in the city's newspaper, shopkeepers noticed an increase in people entering their shops with the sole purpose of finding out more about the project. This confirms recommendations in previous work on publicly situated technology, which suggests that systems that have been advertised beforehand, and are therefore already introduced to people, are more likely to be tried out by people (Maguire, 1999). Due to the unpredictable nature of 'news', this factor is difficult to take into consideration in the early phases of any project. Nevertheless, media coverage can play an important role in getting a community's attention and kickstarting discovery, as previously also demonstrated in the Waiting Wall study (see Section A.1), and therefore exploring ways in which local press can be involved or contacted are likely to be worthwhile.

### **Social media**

Social media can also play an important role in promoting discovery. During the study, people shared the project through platforms such as Facebook and Twitter, with others learning about it as a result. This can be particularly powerful when people or organisations with a large reach share their experiences, such as established leaders, shops, or community groups.

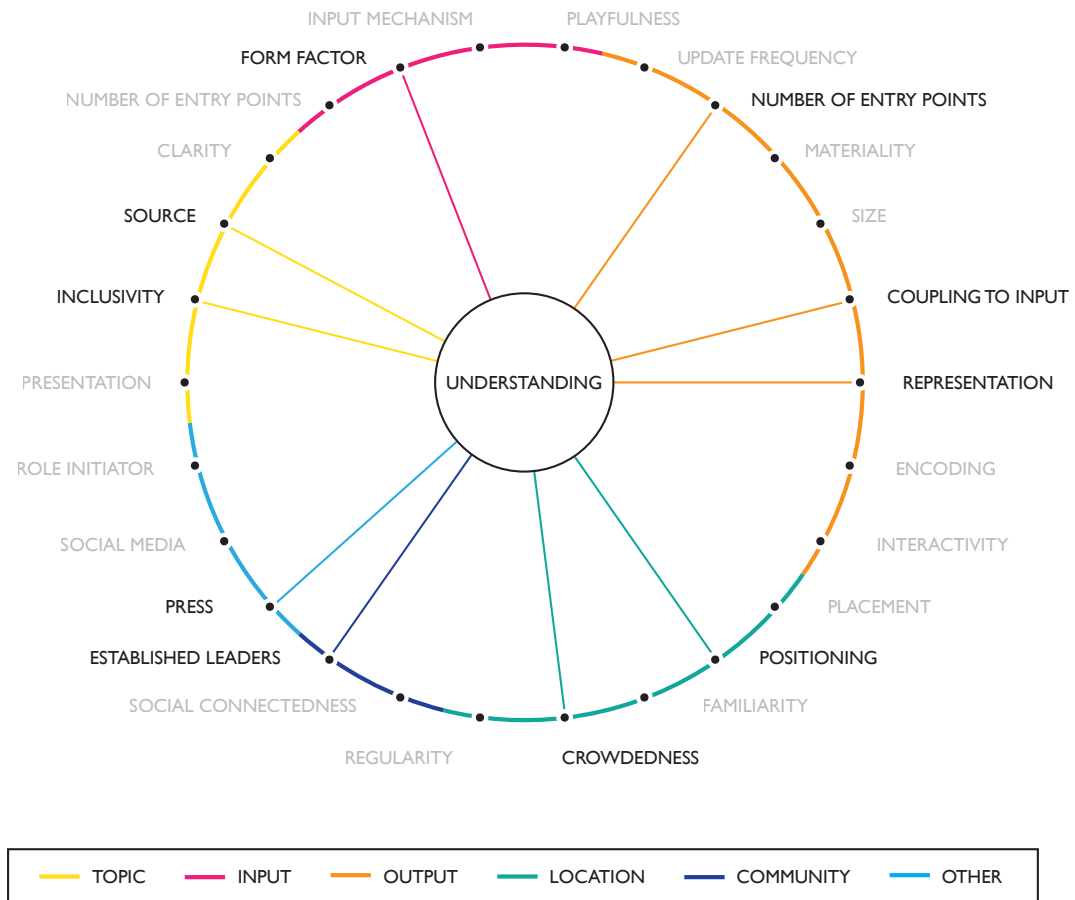
#### **4.5.2.2 Understanding**

##### **Inclusivity of topics**

All selected questions were chosen for their inclusivity, to ensure locals as well as visitors would be able to easily understand them. This successfully enabled people to learn more about the aim of the project, as they were able to read and understand the posed questions. This aligns with Taylor et al. (2012) suggestions on the use of short and simple questions to improve community engagement.

##### **Source of topics**

By sourcing topics from local shopkeepers and residents, a set of topics was identified that could be easily understood by people living and working in the Mill Road community. The use of such community-generated topics also ensured that people could relate to the topics.



**Figure 4.19:** Factors framework: factors relating to understanding

### Input technology form factor

The simple form factor of the voting device, which consisted of a minimal interface, containing only one question and three buttons, enabled people to easily understand the aim of the project simply by looking at the voting device.

### Number of entry points for output

The distribution of visualisations along the street made it possible for people to walk from shop to shop to compare the results between individual shops or between areas.

### Coupling to input

While the input and output were not co-located in the exact same locations, their placement inside and outside the same shops provided a clear coupling. Furthermore, this placement helped people understand the link between the data collection and visualisation process, providing insight about the context in which the data was gathered and luring people inside (see Placement).

**Representation of output**

The design of the situated visualisation focused on the use of relative data. This proved key in fostering engagement. Firstly, this simplified view of the data enabled people, including those unfamiliar with these types of graphical representations, to easily interpret the results. Secondly, it also enabled people to compare the results between questions and shops (see also Number of entry points for output). Furthermore, the relative data allowed people to learn more about the collected data from each shop, without providing insight into participation figures. In other words, the use of relative data ensured that the insights people could glean from the visualisations were on the community's relative differences and similarities in perceptions on different topics, without shifting the focus to the popularity or lack of popularity of individual shops.

**Positioning**

The positioning of the input devices and visualisations in the context of local shops enabled people to observe, read, and compare the questions and visualised data in a natural manner. As window shopping, and browsing items inside a shop, are common behaviours, their actions did not stand out, and the observations and findings from interviews suggest that people did not experience social embarrassment (Brignull and Rogers, 2003), performance anxiety (Akpan et al., 2013), or evaluation apprehension (O'Hara, 2003).

Furthermore, literally positioning the displays on the doorstep of the local shops ensured that customers and passers-by were able to instinctively connect the data with the location. In other words, the contextual positioning of the visualisations directly resulted in further understanding of the data. In addition, this positioning enabled people to compare the results between shops and areas.

**Crowdedness**

The presence of other people near the input technology or visualisations enabled people to observe others interact with the intervention, in order to learn more about it. This worked particularly well during busy shopping times, such as Saturdays (all shops), and evenings (supermarkets, delicatessen, takeaway restaurant).

**Established leaders**

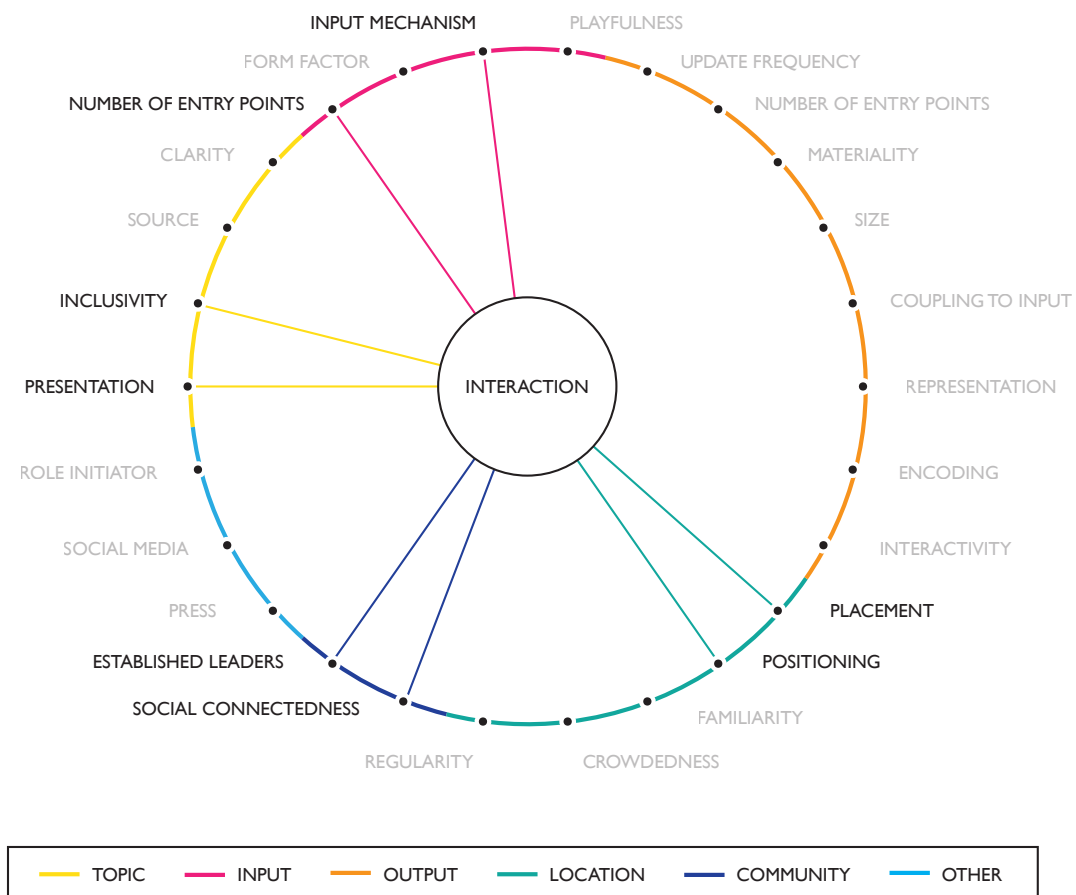
Throughout the deployment, established community leaders, in particular shopkeepers,

helped others to get a better understanding of the project. Most importantly, shopkeepers were always present to answer people's questions about the project.

### Press

The coverage of the study by the local press also allowed people to learn more about the project, and how they could participate, simply by reading an article or listening to a radio show.

#### 4.5.2.3 Interaction



**Figure 4.20:** Factors framework: factors relating to interaction

### Presentation of topics

As a new question was posed every other day, people were encouraged to voice their opinion regularly by interacting with the voting devices. The update frequency successfully fostered repeat interactions over time, by motivating people to return to the shops.

**Inclusivity of topics**

The posed questions were designed to be accessible to locals as well as visitors. As a result, they facilitated participation from diverse demographics.

**Number of entry points for input**

The distribution of voting devices allowed people to submit their vote at different locations. While this behaviour was not observed regularly, the interviews revealed that some people submitted their votes on the same question at multiple locations, to communicate how their perception was location dependent. Furthermore, at several occasions a sense of competition between both shops and areas was observed. On one hand, these types of engagement with the deployment encourage participation as people become more involved. On the other hand, such competition may also fuel foul play, for example when people cast multiple votes in order to manipulate the results.

**Input mechanism**

The interaction mechanism, consisting of three pushbuttons, was found to be understood by people both familiar and unfamiliar with computing technology. This finding corresponds with the findings from Taylor et al. (2012), who argue for the use of simple voting technology as a means to lower barriers to participation.

From the perspective of data collection, however, voting remains limited. For example, the observations and interviews gave insight into the high number of in-depth discussions on safety along Mill Road, during which people exchanged experiences with robberies, abuse, traffic, and a number of other events they linked to safety. Voting technology is by design not able to capture such nuanced viewpoints, and instead reduces these detailed experiences to percentages in the ‘agree’, ‘neutral’, and ‘disagree’ categories.

Furthermore, the ease with which people can participate also gives them the opportunity to contribute multiple times. This case study showed that such repeat votes are cast for a variety of reasons, including out of curiosity, conviction, and to manipulate the results. Regardless of the reasons, however, these occurrences affect the data quality (Taylor et al., 2012; Vlachokyriakos et al., 2014). An adequate filtering process is required to eliminate these repeat votes to prevent such data from being visualised, thereby spreading false information and potentially unfairly impacting the reputation of an area.



**Placement**

The placement of the input technology in locations that were embedded in the existing practices of community members was key in getting people to participate. Moreover, it encouraged people to sustain their participation over time, as visiting these shops was already part of their routine, and returning to the input technology was therefore effortless.

**Positioning**

The positioning of the voting devices on the tills of all participating shops helped encourage participation. This positioning enabled people to cast their vote while waiting at the tills to complete a transaction. As a result, people did not have to go out of their way to take part – instead, the participation process was integrated into an existing practice, filling time that would otherwise be spent waiting.

**Social connectedness**

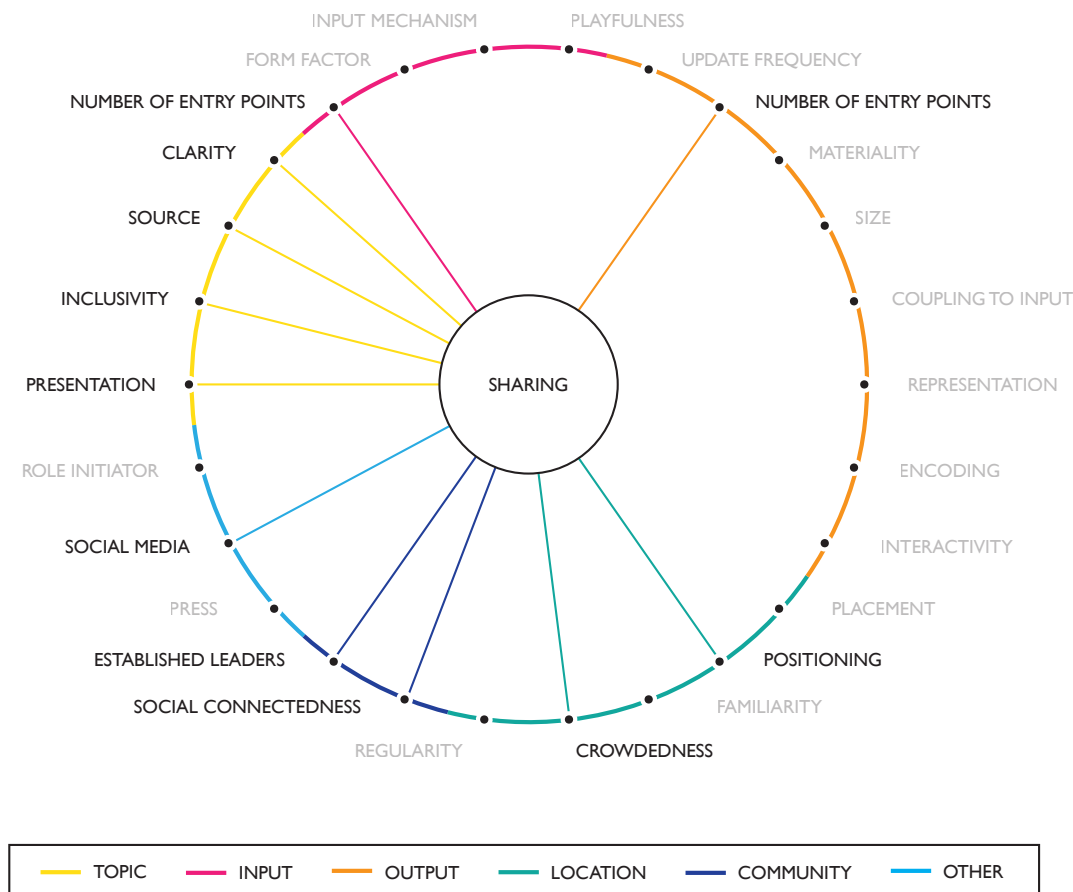
Many of the people who participated were either local residents, or regular visitors of the area. They often had a pre-existing relationship with the area, and the people living and working in this area. As a result, they typically had opinions on the posed questions that were informed by their personal experiences in the area. To some, participation through voting was more than just casting a vote, it also signified awareness of and participation in local events – a sense of belonging to the local area. This was the case for some residents and visitors as well as shopkeepers of shops who did not participate – but approached the researcher during the study to ask if and how they could get involved too.

**Established leaders**

Many established community leaders, such as the organisers of community groups and the shopkeepers, took up an active role in encouraging people to participate. Some voluntarily asked customers to vote while they were waiting at the till, while others took the voting device to customers' tables to encourage them to take part. This championing behaviour was key in getting people to participate.

**4.5.2.4 Sharing****Presentation of topics**

The regularly updated questions provided people with new topics to discuss. Similarly, these updates provided the shopkeepers with new talking points, and new opportunities to champion the project.



**Figure 4.21:** Factors framework: factors relating to sharing

### Inclusivity of topics

As all topics were designed to be accessible to both residents and visitors of the area, they could act as a talking point for all people in the Mill Road area – without excluding anyone. Similarly, this accessibility enabled shopkeepers to actively champion the project without having to consider whether they would be able to understand or answer the question posed on the voting device.

### Topic source

The involvement of a variety of community groups, shops, and local residents during the early stages of the study ensured that the posed questions were highly relevant to people in the Mill Road area. While the process of sourcing questions from locals required the investment of time to understand the context, local issues, and the roles of all stakeholders, this process ensured that the questions and statements sparked public discourse at the input locations. Furthermore, the knowledge from local residents helped identify hyperlocal topics

that are not often spoken about, yet many people feel strongly about. In the case of Mill Road, this primarily concerned the controversial perceived divide between Petersfield and Romsey. These findings show that using knowledge from local residents about a community is key when identifying topics to address, as they are able to pinpoint timely issues.

### **Clarity of topics**

The findings from the observations and interviews show that the posed topics encouraged people to reflect on their views, and moreover, the topics encouraged discourse among residents and shopkeepers. The most discussed topic, safety, was debated in shops along Mill Road. The ambiguity of this topic played an important role in motivating discourse, as it encouraged people to discuss what types of safety they consider to be of importance in the area (e.g. traffic versus pickpocketing). This suggests that intentional ambiguity can trigger increased sharing, as it encourages debate.

### **Number of entry points for input and output**

The presence of both the input devices and visualisations throughout the community ensured that the project could act as a talking point at all locations. More specifically, it allowed for highly localised sharing of perceptions, as people discussed the topics in the context of their exact location along Mill Road (e.g. safety at this part of the street).

### **Positioning**

By positioning the devices in locations where social interaction is known to take place, like shop tills, people were encouraged to talk about their personal perspective with shopkeepers or other customers before or after casting their vote. While the Viewpoint study (Taylor et al., 2012) revealed that participants expressed a desire for higher fidelity technology, that would allow them to express themselves better, such a desire did not emerge from the Mill Road study. This may be due to the sharing of views and perspectives that took place near the project, which may have complemented the limited expressiveness that voting allows for.

### **Crowdedness**

The presence of people near the installation not only attracted more people to the input technology and visualisations – the honeypot effect – it also sparked conversations between customers and shopkeepers. People were, for example, observed joining in on discussions

around local safety that were taking place near the voting devices. Therefore, the presence of small crowds near the installation encouraged sharing.

### **Social connectedness**

The pre-existing social ties within the community facilitated sharing. The connectedness in the area meant that many community members already spoke regularly, and because of this locals did not need to be actively encouraged to discuss the project – it happened naturally.

### **Established leaders**

The involvement of established community leaders in the project, shopkeepers in particular, provided people with the ability to share their perspectives, and to ask about the experiences of others. As people were already familiar with these leaders, they acted as trusted and informed resources. Because of this role, the established leaders could engage in championing behaviour, convincing people to take part, encouraging them to discuss, and motivating them to look at the visualised data.

### **Social media**

The sharing of insights about and photos of the project on social media further promoted remote discussion and sharing.

## **4.6 Summary**

This chapter described a 3-week long in-the-wild study investigating the use of multiple voting devices and public visualisations distributed along a street to encourage local participation. The study showed how affordable, low-tech solutions, that can be easily set up and placed throughout a locale – such as simple cardboard voting devices – can evoke community-wide involvement, especially when the technology is embedded in existing community practices. The distributed approach was found to encourage comparison between situated visualisations, and the use of delayed but regular updates was found to encourage revisitation of the input and output. Furthermore, the involvement of existing community leaders – local shopkeepers – proved key in facilitating discovery, understanding, and sharing, as these trusted leaders were often keen to champion the project and to discuss the posed questions and statements.

The next chapter describes a follow-up study conducted along Mill Road during the street's annual Winter Fair. Building on the lessons from the Visualising Mill Road study, the next chapter explores if and how engagement can be encouraged in an event setting.



## Chapter 5

# Case Study II: Fair Numbers

### 5.1 Introduction

While the Visualising Mill Road case study showed how publicly collecting and visualising hyperlocal data can engage people in a neighbourhood setting, a large part of social life in cities revolves around local events like fairs, markets, and festivals. Case Study II, Fair Numbers, builds on the findings from Visualising Mill Road, but instead aims to engage people in an event setting: the annual Winter Fair along Mill Road. The inclusion of such an event setting was deemed particularly valuable as these type of activities are an inherent part of social life in urban communities – and thus provide an opportunity for large-scale engagement with local topics.

The objective of the follow-up study was to design a public visualisation that would provoke attendees' perception of a community event, by providing them with objective data on the event (collected by sensors) and comparing it to subjective data (collected from people). Whereas the Visualising Mill Road study addressed a community in a day-to-day setting, the aim here was to investigate how a public visualisation affected local perceptions in the same street in a different context – when deployed at a one-day fair. The motivation behind the study was to explore how locally collected data could be reflected back to people from all walks of life, who were attending the community fair, to provide them with a means to think about, compare, and share objective and subjective data. In addition, the study was used to explore how subjective and objective data can be gathered simultaneously, using a variety of data collection methods.

Fair Numbers was a collaboration with Dr Vaiva Kalnikaitė, and several other researchers were involved in the data collection process during the event (see Section 3.5).

### 5.1.1 Setting

The study was, again, carried out on Mill Road (Cambridge, UK) at the request of the local community groups, who were keen to take part in another project after the Visualising Mill Road study. However, the setting was highly different as the study was focused on the street's annual Mill Road Winter Fair, which attracts an estimated 10,000 to 15,000 attendees from the local community, wider Cambridge, and beyond.

During the fair, local traders and residents sell a broad range of food items from stalls placed along the street. In addition, a variety of other activities take place, including a parade and various musical performances. The events are distributed along the road, thus encouraging attendees to visit both the Petersfield and Romsey areas.

### 5.1.2 Research objective

The specific research focus of the Fair Numbers study was on the use of topics related to the environment of the setting, distributed voting technology, and a central, regularly updated visualisation (as shown in Figure 5.1). This focus is further detailed below.

CASE STUDY	TOPIC	INPUT	OUTPUT
I: VISUALISING MILL ROAD	COMMUNITY-GENERATED	VOTING (D)	DELAYED UPDATES (D)
<b>II: FAIR NUMBERS</b>	<b>ENVIRONMENTAL</b>	<b>VOTING (D)</b>	<b>REGULAR UPDATES (C)</b>
III: VOXBOX	EVENT FEEDBACK	MIXED (C)	REAL-TIME UPDATES (C)
IV: VOXBOX REAPPROPRIATED	PERSONAL	MIXED (C)	TAKEAWAY (C)
V: SCRIBBLES, MAGNETS, TYPEWRITER	OPEN-ENDED	TEXTUAL (D)	INTERACTIVE (C)
VI: URBAN TYPEWRITER	CONSULTATION	TEXTUAL (N)	DELAYED UPDATES (N)

**Figure 5.1:** Research focus of the Fair Numbers case study (D = distributed, C = central, N = nomadic)

The aim of the Fair Numbers case study was to explore how publicly collecting and visualising data during a popular community event can engage people. The study also provided the opportunity to investigate whether the types of engagement behaviour differed between the Visualising Mill Road and Fair Numbers deployments.



Unlike during the Visualising Mill Road study, topics could not be sourced from the community – as the event attracts people from all over Cambridge and the neighbouring regions, who cannot be consulted before the start of the fair. Therefore, this study was used to investigate the usage of more generic topics that are accessible to people regardless of their background. The deployment focused specifically on the use of topics related to the environment of the event:

**FN RQ1: How does the use of environment-related topics affect engagement?**

The aim of these topics was to act as inclusive themes, resulting in questions that can be answered by anyone attending the event.

Like the Visualising Mill Road study, the Fair Numbers study investigated the use of distributed voting technology as input mechanism. However, instead of custom voting devices, tablets were used to examine how off-the-shelf technology can act as input technology:

**FN RQ2: How does the use of off-the-shelf input technology affect engagement?**

By using readily available technology, the intention was to provide people with technology they were likely to be familiar with – to ensure people would be able to submit their perceptions easily.

Building on the findings from the Visualising Mill Road study, where the use of delayed updates created anticipation, the Fair Numbers study was used to explore the use of regular, but not real-time, visualisation updates:

**FN RQ3: How do regularly updated visualisation updates affect engagement?**

As the setting did not allow for multi-hour or multi-day delays between updates, due to the limited duration of the event, these regular updates were designed to mimic delays – with the intention of, again, creating anticipation.

## **5.2 Design**

### **5.2.1 Conceptual design**

To learn more about the annual community fair, the design process was started with informal conversations with people who had taken part in the Visualising Mill Road study,

including shopkeepers, members of Mill Road community groups, city council representatives, and the organisers of the fair. These conversations provided insight into the scale of the event, the atmosphere and the activities organised throughout the day – informed by people’s experiences of the fair in previous years.



**Figure 5.2:** Brainstorm session

As the vast majority of attendees of the fair were expected to be visitors, the approach to the design of the intervention had to be different from the Visualising Mill Road approach. Whereas during the first case study it was possible to involve targeted participants – such as residents – in the design process, these targeted participants could not be consulted for the Fair Numbers study. Instead, the conceptual design was informed by past event experiences and knowledge of situated technology from a group of eight HCI researchers. These researchers were invited to take part in a one and a half hour brainstorm session to explore ideas for a suitable intervention.

The session was structured as follows: during the first phase, a brief introduction was given of Mill Road and the event that would take place. Photos of the street during normal days as well as photos from previous editions of the event were shown to give an impression of what could be expected. This was followed by the second phase: an initial brainstorm on the types of data that could be gathered. All researchers were given sticky notes and were encouraged to write down as many data collection ideas as possible. To foster creativity, the researchers were told to temporarily disregard the practical implementation of their ideas. Afterwards, ideas were collaboratively discussed and grouped into the following categories:

1. Data that can be collected using *sensors* (e.g. air quality sensors)
2. Data that can be collected via *explicit input* (e.g. voting device)

### 3. Other types of data

After the grouping of suggestions was completed, the third phase was started, during which researchers were asked to consider different ideas on how the data could be fed back to the people attending the event. Again, ideas were written down by the individual researchers, on sticky notes of a different colours. Where possible, these visualisation ideas were then matched with one or more of the suggested data collection ideas. In total, 50 data gathering ideas were suggested, and 31 data presentation ideas. Common themes included collecting data around available food (e.g. most popular types of food), information about the crowd (e.g. which part of the fair is most popular), and purchases made by attendees (e.g. how much money has been raised for charity). Ideas for data presentation ideas ranged from the use of smoke, to digital screens, street furniture, and projections (a complete overview of ideas can be found in Appendix B).

From the discussions during the workshop, the idea emerged to provoke attendees' perception of the event by providing them with objective data on the event (as measured by, for example, sensors) and publicly comparing that data with attendees subjective perceptions – collected using situated input technology. This narrowed down the list of suggested data collection ideas: the focus of the project would have to be a topic that could be measured both objectively and subjectively.

#### 5.2.2 Topics

The brainstorm provided a list of suggestions around data collection and presentation, and focused the project on collecting data around a topic that could be measured in an objective and subjective manner. Using these suggestions, a shortlist of ideas was created by the researcher, based on two criteria. Firstly, the collected and visualised data would have to be inclusive. In other words, it would not have to require pre-existing knowledge about the Mill Road area – both locals and visitors would have to be able to easily understand the topic, and answer any questions related to it. Secondly, it would have to be feasible to measure data related to the topic in an objective and subjective manner. This meant the project would have to rely on readily available input technology and sensor technology.

During the shortlisting process it quickly became apparent that many of the brainstorm ideas would be relatively difficult to implement, as they would require custom sensors. However,

two suitable event-specific topics emerged: crowdedness and noisiness. During the brainstorm session these topics were brought up as being key elements of the success of an event, as they relate to the ‘buzz’ of an event, and describe to what extent an event is ‘lively’ and ‘happening’. In order to ask attendees about their subjective experience of the event, the two topics were transformed into the following two questions:

- How crowded is it currently?
- How noisy is it currently?

The choice of words for both questions was deliberated at length, as both the words ‘crowded’ and ‘noisy’ can have negative connotations – potentially affecting how people answer the questions. However, alternative words, such as ‘busy’ and ‘loud’, were considered equally, if not more negative. The questions were purposely designed to be short, to enable attendees to read them at a glance while walking through the fair. Furthermore, the questions were formulated in such a way that they explicitly referred to the here and now, by using the word ‘currently’. This reference was included to ensure that attendees would take their immediate surroundings into account when answering the question – rather than answering the question based on their experience of the event on the whole.

### 5.2.3 Input technology design

The objective of the input technology was to collect both subjective and objective data of the crowdedness and noisiness of the fair, which could then be used to publicly display to all attendees through a situated visualisation. For both types of data collection four data collection points were identified, along the street.

To collect objective data on the sound levels along Mill Road, use was made of four Smart Citizen Kits (Fab Lab Barcelona, 2013), sensors designed to collect a range of environmental data. These small sensors, approximately 6 by 6 cm, were placed inside custom 3D printed enclosures and attached to four lamp posts along the street (see Figure 5.3). The data collected by the Smart Citizen Kits was uploaded in real-time, using mobile WiFi hotspots that were also attached to the lamp posts.

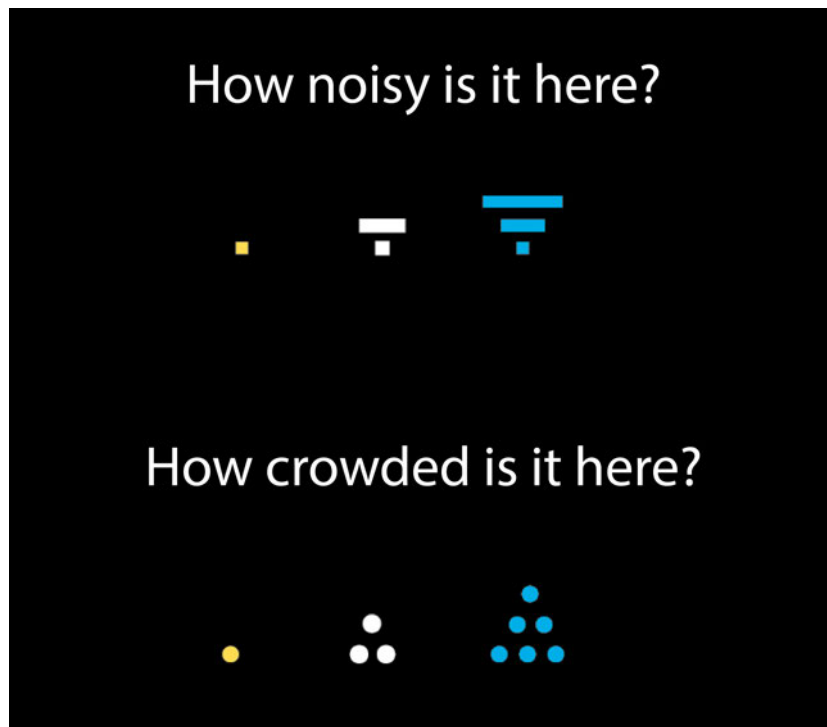
To collect objective data on the levels of crowdedness along Mill Road, use was made of photographs taken at regular intervals. Collecting data on crowdedness proved to be significantly more complex than collecting data on sound, as it is not as obvious how to measure



**Figure 5.3:** Smart Citizen Kit attached to lamp post on Mill Road

crowdedness. Initially, the use of video cameras was considered. However, this was deemed too intrusive and reminiscent of surveillance, and therefore not appropriate for this type of event. In addition, the placement of motion sensors to count passers-by would not be feasible due to the width of the road. Therefore, the decision was made to instead take photographs at regular intervals at the four data collection points along Mill Road, to capture differences in crowdedness throughout the day. All photos were taken at the exact same locations, using a wide-angle lens. The number of people within the photographs was counted to get a sense of the relative crowdedness.

To collect subjective data on both crowdedness and noisiness, use was made of a custom tablet application. Similar to the Visualising Mill Road study, the aim was to design the intervention in a way that would enable as many people as possible to participate in the data collection process. Initially, the plan was to deploy a range of voting devices from the Visualising Mill Road study along the road, at different stalls. However, it quickly emerged that their small size would likely mean they would go unnoticed during the event, particularly due to the crowdedness that was expected near the stalls. Therefore, the decision was made to instead use portable input technology that researchers along the street would be able to present to attendees of the fair. A custom Android tablet application was developed that displayed the question, and three answer options (low, medium, high). By tapping one of the options, a vote would be submitted and logged on the device. After the first question



**Figure 5.4:** Screenshot of voting application

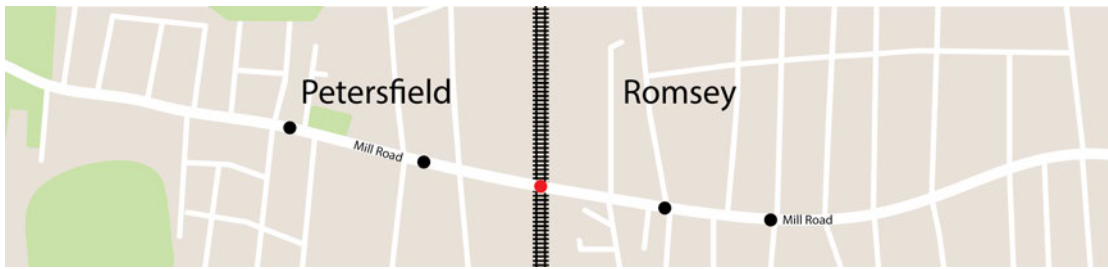
had been answered, the application displayed the second question, enabling people to answer both questions in sequence.

Throughout the day, four researchers were positioned along Mill Road, in the four data collection locations. These researchers actively approached people and asked them to submit their perceptions of the event. Using portable tablets enabled the researchers to approach people directly, in person, to ask them to select their answers. Furthermore, this approach allowed data to be collected and processed on the spot. The custom application was designed to automatically generate summaries of the collected data, to easily communicate the latest data and keep the public visualisation up-to-date.

#### 5.2.4 Choice of input technology locations

In order to involve people along the street, throughout the event, a distributed approach was chosen, inspired by the Visualising Mill Road study. Input technology was distributed at four data collection points (see Figure 5.5), to cover the event's main area. These locations were selected based on the information provided by the event organisers, which suggested the middle part of Mill Road would likely be the most crowded. In all four locations, sound

sensors were attached to lamp posts, researchers were positioned to collect perceptions from attendees, and photos were taken of the crowd at regular intervals.



**Figure 5.5:** The four locations where people could vote (black dots) and the central location where the data was visualised (red dot)

### 5.2.5 Visualisation design

A key aspect of the intervention was the public visualisation of all collected data during the event. This visualisation was designed to communicate the data in an accessible manner by relying on simple representations, making it easy for passers-by to understand what was visualised. The aim was to give a comprehensive overview of all four types of data: subjective noisiness, objective noisiness, subjective crowdedness and objective crowdedness. Furthermore, the visualisation was designed to allow people to compare the levels of noise and crowdedness over time.



**Figure 5.6:** Sketch of the visualisation of objective and subjective data gathered during the one-day community fair

The primary challenge for the visualisation design was representing all four types of data in an understandable way. The sketching process spanned over several weeks, exploring a range of representations suggested during the brainstorm session, ranging from simplified 2D maps to 3D balloons. Representing both spatial data (differences in noisiness and crowdedness along the road) and temporal data (differences in noisiness and crowdedness over the course of the day) proved to be complex. Therefore, the decision was made to focus the visualisation on the differences over time, by representing the data along a timeline.

To allow for easy comparison between subjective and objective data, the collected objective data was divided into three categories: low, medium, and high. For example, photographs with a relatively low people count were categorised as ‘low’ crowdedness. As this categorisation was based on relative crowdedness and noisiness during the day, it was expected that small adjustments would have to be made throughout the event (e.g. when a people count is first considered ‘high’, but photograph taken at a later stage has a far higher people count, the former would be corrected to ‘medium’). The three-level categorisation mapped onto the answer options provided through the tablet application, and as a result enabled direct comparison.

For the visualisation of noisiness, the choice was made to adapt a highly familiar representation of sound: three curved lines emerging from a speaker. To simplify the visualisation, these curved lines were transformed into straight lines, which were coloured in either partly or fully, depending on the collected data (see Figure 5.6). For the visualisation of crowdedness, use was made of baubles, as an abstract representation of people when viewed from above. The more baubles, the more crowded the street during that time. Baubles were also attached in triangular shaped, to visually match the aesthetics of the sound representations (see Figure 5.6). Large labels were displayed left of the representations, indicating whether they showed data collected from the deployed sensors (‘sensor’) or from the attendees (‘you’). In addition, the labels ‘sound’ and ‘crowd’ were added to the visualisation, to communicate which measurements were visualised. The decision was made to use these annotations, as opposed to ‘noisiness’ and ‘crowdedness’, to avoid possible negative associations with these terms. Furthermore, because these terms were shorter, the labels could be displayed in a larger font size, making them more visible. Building on the street art theme of Visualising Mill Road, use was made of neon tape to visualise the data. In addition, plastic neon Christmas baubles were used to visualise crowdedness, to fit the Christmas theme of the fair.

### 5.2.6 Choice of visualisation location

To ensure high visibility, the railway bridge in the middle of the street was chosen as the most suitable location to situate the public visualisation (see Figure 5.5). While there were various alternative locations available, the aim was to make sure as many people as possible would walk past the visualisation. Due to its central position on the road, the vast majority of people at the fair would cross the bridge at some point during the day. Furthermore,



the walls located at the sides of the bridge provided a large canvas, suitable for the public visualisation: 30 meters in width by 2 meters in height. For this deployment, the decision was made to present the visualisation on a vertical surface, rather than to spray the data on the street again, as the crowdedness during the day would have likely made it difficult for people to notice and read a visualisation positioned on the ground.

### 5.3 In-the-wild study design

On the morning before the start of the event, the Smart Citizen Kits were mounted on lamp posts in the four selected data collection points along Mill Road. Furthermore, a team of researchers covered up the bridge with black plastic sheets, thereby creating a blank canvas. The layout of the visualisation was then outlined on this canvas, including all labels and time stamps. Four researchers positioned themselves at the four data collection points to approach people with the custom tablet voting application. Two researchers were positioned on the bridge, to regularly update the visualisation. One researcher moved along Mill Road, taking hourly photographs of the crowd in the four data collection locations.

Every hour, both the subjective and objective data were collated by the researchers positioned on the bridge. The initial measurements at the start of the fair, when it was still very quiet and none of the activities had started, were used as baseline ‘quiet’ measurements, for both crowdedness and noisiness. All measurements taken later in the day were compared to these ‘quiet’ measurements and categorised accordingly (see Figure 5.8). Seeing as the close to real-time visualisation required the data to be interpreted and compared continuously, this also meant the visualisation had to be adjusted as the day progressed. When, for example, lower-than-baseline sound measurements were taken, the sound visualisations were re-categorised.

Again a mixed methods approach was used to evaluate people’s engagement with the visualisation and the four data collection points. The following data was collected to examine engagement: (i) logged votes from the tablet applications; (ii) observations in-situ at the data collection points and the public visualisation.

### 5.4 Findings

The Mill Road Winter Fair attracted, as expected, approximately 10,000 attendees over the course of the day (see Figure 5.7). Throughout the day, researchers approached attendees to

ask them to submit their perceptions of the noisiness and crowdedness at that time and location. While a large number of people agreed to participate, who casted a total of 1093 votes, the study also revealed that the chosen input technology caused confusion amongst attendees of the event, who associated the use of tablets with salespeople. Similarly, the combination of the input technology and the chosen topics gave some attendees the impression that the noise and crowd levels were being measured by local authorities, in order to monitor the extent to which the fair was a nuisance for the neighbourhood. While the event revealed a number of flaws in the design of the intervention, the public visualisation did evoke curiosity, provoke discourse, encourage comparison, and invite tactile interactions, as described in detail in the following sections.



**Figure 5.7:** Two example time sequences of crowdedness during the fair

### 5.4.1 Contributions

During the event, a total of 1093 votes were cast via the tablets. Of these, 553 answered the question related to crowdedness, and 540 answered the question related to the sound level. Thirteen people did not complete the second question. From observations it emerged this was primarily caused by people who voted quickly while walking past, without realising a second question would follow. As shown in Table 5.1, all four locations received similar numbers of votes, approximately 270 per data collection point. For both the crowdedness and noisiness question, the majority of votes were cast for ‘medium’ (respectively 58.2% and 52.6%). Overall, relatively many people perceived high crowdedness (25.5%). In contrast, 37.6% of the people who voted perceived low noisiness, as shown in Table 5.1.

Location	Question 1: crowdedness				Question 2: sound			
	Low	Med	High	Total	Low	Med	High	Total
1	23	95	18	136	59	67	6	132
2	20	69	53	142	33	83	26	142
3	25	94	30	149	72	71	8	151
4	22	64	40	126	39	63	13	115
Total	90	322	141	553	203	284	53	540
Total (%)	16.3%	58.2%	25.5%	100%	37.6%	52.6%	9.8%	100%

**Table 5.1:** Overview of votes per location

The observations by the researchers at the four data collection locations revealed two key reasons for people not contributing. Firstly, because only one researcher was situated in each data collection location, only a small number of the attendees that walked past could be approached. While the other people may have come across the project at one of the other data collection points, it is also highly likely that not all people who attended the event came across the input devices. Secondly, it emerged that people associated the use of tablets in combination with researchers actively approaching attendees with salespeople – and assumed that they were being asked to pay for a product or service (e.g. *“Are you trying to sell me something?”*). In addition, some attendees presumed that the questions were being asked by, or on behalf of, local authorities, to regulate nuisance caused by the fair. These two misconceptions, caused by the chosen input technology and topics, were found to act as a barrier to participation for a proportion of attendees by researchers at all four data collection locations.

### 5.4.2 Curiosity

During the fair, a continuous stream of people passed by the visualisation, many of whom stopped to take a look at it. For those who had already come across one of the researchers on the road, who had asked them to enter their perceptions of crowdedness and noisiness, the visualisation provided an opportunity to compare their personal perceptions with those of others, and the objective data. However, many people who approached the researchers on the bridge had not come across the data collection locations yet, and instead approached the visualisation to learn more about how the data was collected and why. This curiosity sparked conversations between strangers, where one explained the visualisation and aim of the measurements to the other.

Furthermore, it was observed that adults as well as children had a tendency to touch the visualisation while trying to interpret the data. The playful and colourful design, combined with the three-dimensional baubles and the texture of the neon tape, was found to evoke curiosity and attract tangible interaction (see Section 5.4.6).

The input devices were not found to evoke curiosity. Instead, people generally had to be actively approached by one of the researchers in order for them to notice the custom tablet application. The small size of the tablets, and the crowdedness of the event, likely affected the visibility of the input technology.

### 5.4.3 Revisitation

The regular updates of the visualisation ensured that new data would be available every hour. This rhythm of updating, inspired by the Visualising Mill Road study, motivated some people to return to the installation (e.g. *“I’ll come back in an hour, to see how it has changed”*). The researchers observed several people who viewed the visualisation two or more times throughout the day. However, this did not appear to be a common occurrence. No one was observed returning to the input devices.

### 5.4.4 Discourse

Many of the attendees were found to be keen to discuss their perceptions of the crowdedness and noisiness, both while entering information into the tablet application and when looking at the visualisation. Some people emphasised their positive experience of the crowdedness and noisiness (e.g. *“It is noisy, but a good noisy”*; *“It is a wonderful level of crowdedness and noise”*; *“When the band starts, it gets lovely and noisy”*; *“It’s a funky noise, I like it!”*), while others found the fair to be lacking in noise and crowdedness (*“It should be noisier”*; *“I expected it to be noisier. The noise is patchy, I’d expect more people in groups – talking”*; *“I’d expect it to be a lot more crowded. I mean, it’s Cambridge, isn’t it?”*). The input technology and visualisation were observed to be sparking conversations within groups of attendees, between strangers, and between attendees and the researchers. Many of the discussions revolved around comparisons with previous years and experiences elsewhere, as described in the following section.

### 5.4.5 Comparison

When discussing the crowdedness and noisiness, people were observed often comparing their perceptions with their knowledge of what the fair was like in previous years (e.g. *“Not crowded*

at all compared to last year”; “It will soon change!”; “It will be noisier later! This is what I’d expect at this time”), or with their experiences elsewhere. The latter consisted both of comments on cultural differences (e.g. “Maybe for British people this is noisy, but I’m Spanish, we love noise”; “We’re from the continent, we like it loud”; “Not crowded at all, we’re from London!”) as well as different events (e.g. “It’s like Glastonbury, but colder and on a street”).

The large visualisation also enabled people to compare data collected at different times during the day. This was found to encourage people to walk past the bridge’s wall to view all data.

#### 5.4.6 Tangible interactions

For the display used in the Fair Numbers, use was made of two alternative visualisation materials: neon tape and neon Christmas baubles. These materials were chosen because they were colourful, lightweight and easy to attach to the canvas in various shapes. During the in-the-wild deployment it became apparent these materials had another affordance: they attracted people to the visualisation (see Figure 5.8). The tape’s and baubles’ textures and shapes proved to have a natural appeal, motivating people to approach the visualisation in order to touch the visualisation.

During the fair, two types of tangible interactions were observed: firstly, attendees who touched the visualisation merely because they were attracted to the textures and shapes. This group consisted primarily of kids, for whom the displayed data was generally not of interest; they just wanted to play. A number of people (both adults and kids) in this category expressed disappointment when they discovered there were no interactive components, with one passer-by asking “What does this do?”, and another passer-by saying “I expected [the baubles] to light up”. Secondly, those who touched the visualisation while interpreting or talking about the data. This group consisted only of adults. It appeared that these people did not expect any response from the objects they touched. Instead, they used the tangibility of the visualisations as an aid while thinking about the visualisation.

### 5.5 Discussion

The objective of this case study was to investigate engagement with an urban visualisation intervention in an event setting. Specifically, the study looked into three design aspects: the use of environment-related topics, off-the-shelf input technology, and regular visualisation



**Figure 5.8:** Passers-by looking at and touching the visualisation

updates. In the following sections, the role of these aspects will be discussed in detail, followed by a description of the types of engagement the intervention evoked, and the design and contextual factors that were found to affect this engagement.

**FN RQ1: How does the use of environment-related topics affect engagement?**

The study revealed that the use of environment-related topics successfully supported the creation of an inclusive project – as all participants were able to understand and answer the questions. However, pre-existing associations with the topics, which some people related to nuisance regulations and monitoring by the council, were found to act as barriers to participation that discouraged engagement. Especially the combination of the environment-related topics and the use of tablets as input technology was found to evoke these associations, as described below.

**FN RQ2: How does the use of off-the-shelf input technology affect engagement?**

The use of tablets was intended to provide people with a familiar technology they could easily interact with. While the tablets indeed successfully facilitated simple touch interactions,

allowing people to vote easily and quickly, they also proved to act as a barrier to participation. As the tablets were held by researchers along the street, who actively approached attendees of the event, people associated their use with the activities commonly associated with salespeople and council monitoring. This highlights the care that needs to go into selecting appropriate input technology, to ensure inclusion while preventing negative associations.

### FN RQ3: **How do regularly updated visualisation updates affect engagement?**

The regular updating of the visualisation was intended to create anticipation among attendees. The findings showed that, unlike during the Visualising Mill Road study, this did not result in regular revisitation of the visualisation. The temporary nature of the event, and the high number of other activities during the day, likely affected this.

#### 5.5.1 **Types of engagement**

Similar to the Visualising Mill Road study, the Fair Numbers study showed that people experienced different stages of engagement with the situated input technology and public visualisation – from discovery to understanding, interaction, and sharing.

In the discovery stage, people **noticed** one of the four input devices, for example after being approached by one of the researchers, or the public visualisation. Following this, people **approached** the visualisation, to have a closer look. Unlike the Visualising Mill Road study, people were not regularly observed approaching the input devices, as it was typically the researcher who approached the attendees instead. Similarly, while some people **returned** to the visualisations, this did not appear to be common, and none of the attendees were observed returning to the input devices.

In the understanding stage, people **observed** others who submitted their opinions via the custom tablet applications, in order to learn more about how to participate. In addition, people **read** the questions displayed on the input technology, and the data displayed on the visualisation. In order to understand the data, some participants **questioned** the researchers, or others around them, about the project. While viewing the visualisation, people were also observed **comparing** the data collected at different times during the day. No observations were made of attendees reflecting on the topics of noise or crowdedness.

In the interaction stage, people **submitted** their perceptions of the event using the input technology. Furthermore, in this stage people **touched** the public visualisation.

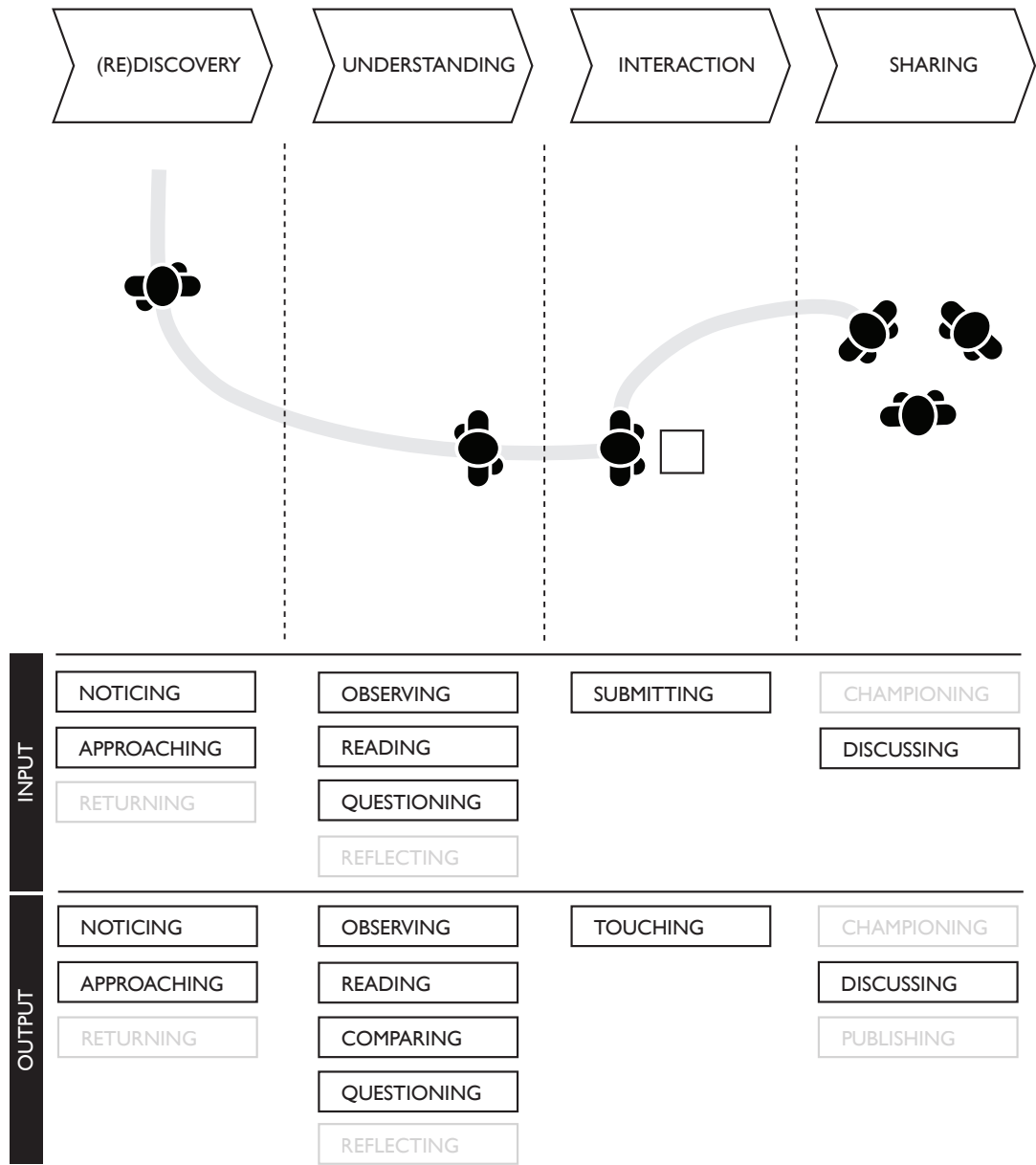


Figure 5.9: Types of engagement with the input technology and output visualisations

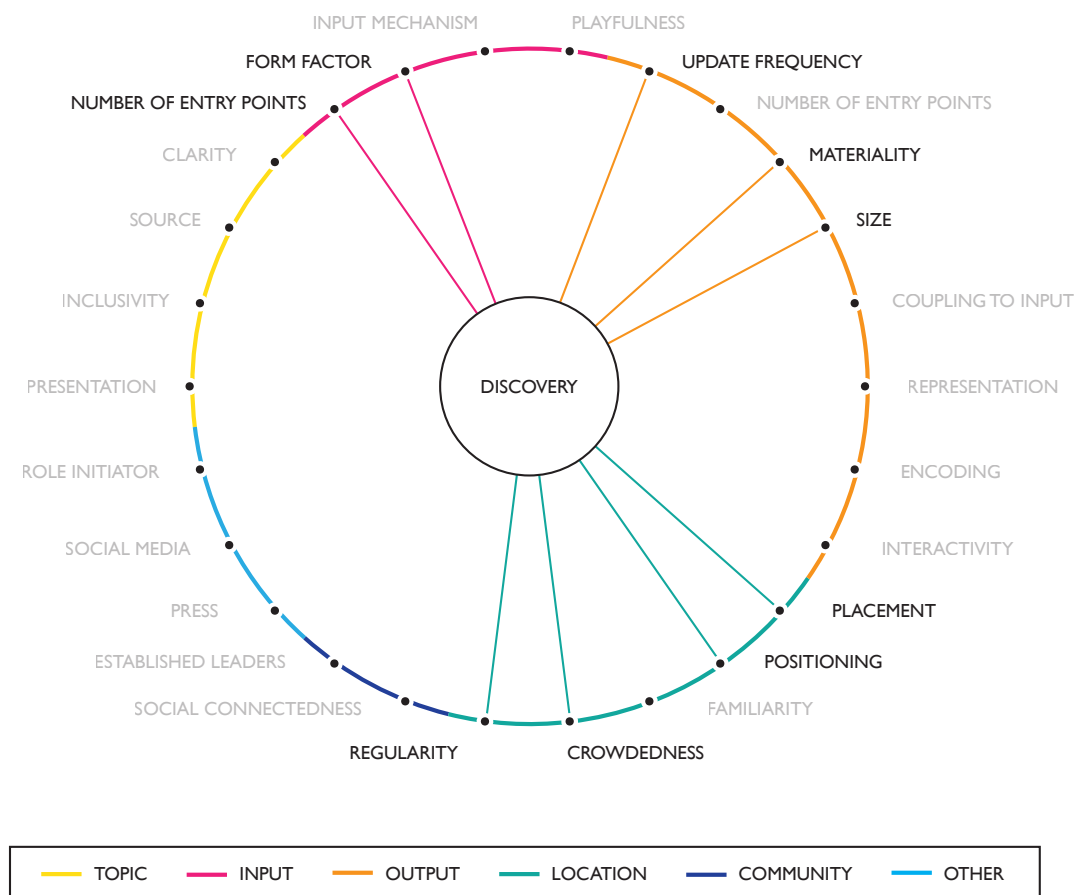
In the sharing stage, people **discussed** the topics of crowdedness and noisiness with other attendees or the researchers. These conversations were typically brief. In contrast with the Visualising Mill Road study, no championing behaviour was observed during the event. Similarly, the project was not actively shared via traditional media or social media. Overall, the intervention did not evoke sharing behaviour.



## 5.5.2 Design and contextual factors

How different design and contextual factors were found to impact the four stages of engagement is described in detail in the following sections.

### 5.5.2.1 Discovery and rediscovery



**Figure 5.10:** Factors framework: factors relating to (re)discovery

#### Number of entry points for input

The presence of four data collection locations ensured that many people came across at least one researcher while walking down the street. However, due to the crowdedness at the event, only a proportion of attendees could be approached by researchers. A higher number of entry points would have likely ensured that more people would have discovered the project.

#### Input technology form factor

The selected form factor of the input devices, namely off-the-shelf tablets, did *not* promote discovery – as the colour and size of the technology did not stand out in the event setting.

As a result, the researchers had to take up an active role in encouraging engagement with the project. More noticeable technology would have likely improved discovery of the intervention.

### **Update frequency of output**

While it was not a regular occurrence, some people were observed returning to the visualisation to view the recently added data; the systematic updating process promoted some revisitation.

### **Materiality of output**

The tangible elements of the visualisation, the colourful baubles in particular, were found to catch the eye of passers-by, promoting discovery of the intervention.

### **Size of output**

The size of the visualisation, which was displayed on a 30 meter by 2 meter canvas on the bridge, ensured that many passers-by noticed the intervention – despite the many other activities taking place. The length of the visualisations proved particularly effective, as it enabled discovery across the bridge.

### **Placement**

The distribution of the input technology along the street ensured that the intervention was accessible to all people who passed through the area. Similarly, the central placement of the visualisation successfully encouraged discovery throughout the day, as a large number of people crossed the bridge while attending the event.

### **Positioning**

The positioning of the input technology in the hands of researchers meant that the technology was not highly visible. The researchers, therefore, took up an active role in approaching passers-by and positioning the tablet application in such a way that they could easily read the displayed information.

On the other hand, the positioning of the visualisation on a large vertical surface made it easy for passers-by to notice the visualisation while walking across the bridge.

### **Crowdedness of location**

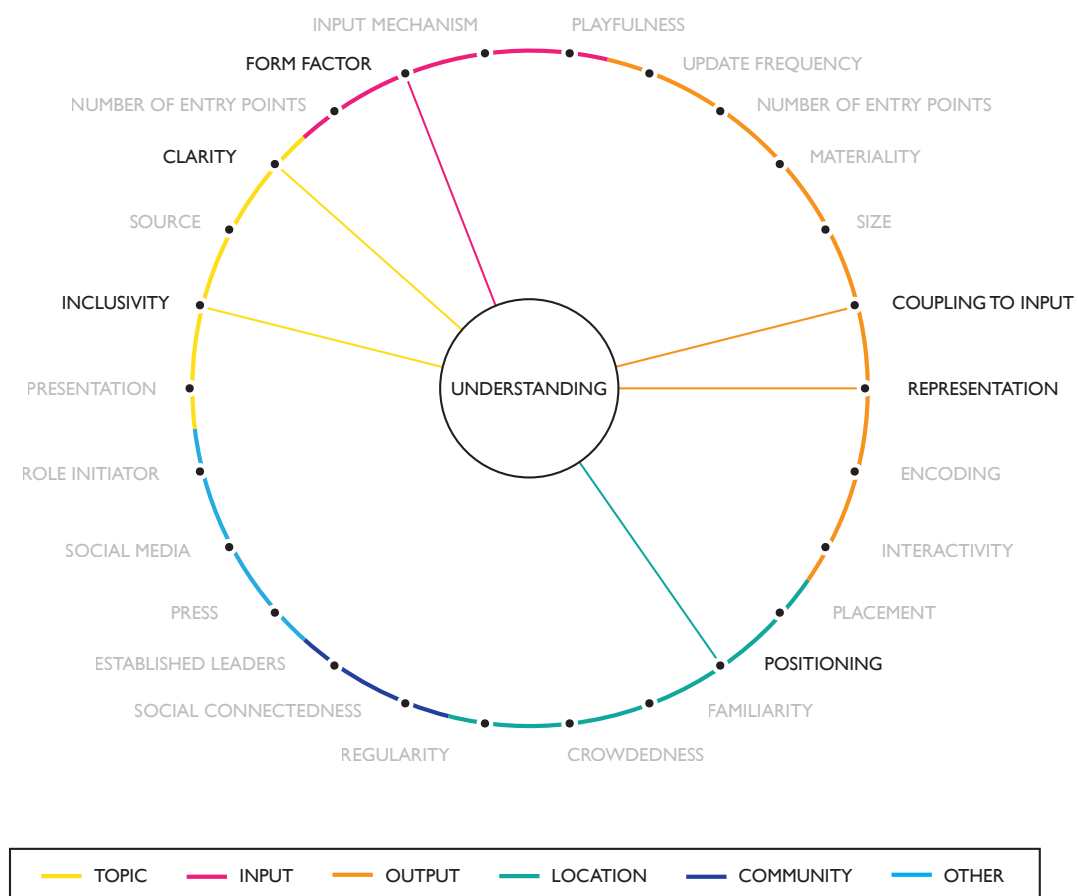
The event attracted thousands of people to the street. This made it possible for the researchers to approach many attendees. However, at the same time, the crowdedness made

it more difficult for people to discover the intervention on their own accord, as the crowds obstructed their view of both the input technology and the visualisations.

### Regularity of location

On the whole, the presence of a large number of other activities at the event – such as food stalls, a parade, and live music – was found to make the intervention less noticeable – as all these activities attempted to attract people’s attention simultaneously.

#### 5.5.2.2 Understanding



**Figure 5.11:** Factors framework: factors relating to understanding

### Inclusivity of topic

As both questions addressed the universal concepts of noisiness and crowdedness, they were easily understood by local residents as well as visitors.

### Clarity of aim

While the topics were inclusive and understandable, they did *not* clearly communicate the overall aim of the intervention. As a result, the topics caused confusion amongst attendees,

who associated these questions with nuisance monitoring by the council. This association was further strengthened by the form factor of the input technology, as described below.

### **Input technology form factor**

The use of a tablet with a touch screen and custom voting application as an input device did *not* help understanding of the project, as attendees associated the use of this technology with salespeople – who regularly use tablet to encourage people to sell goods or services to passers-by. Alternative technology, that does not evoke such negative associations, would have likely helped communicate the overall aim of the project in a better way.

### **Coupling to input**

The visualisation of the collected data was presented in a central location on the street, while the input technology was placed in other locations along the street. As a result, there was no clear coupling between the input and output, which left people who had not encountered the input technology with questions about the origin of the displayed data.

### **Representation of output**

The representations chosen for the visualisation of sound and crowdedness levels, consisting of simple 3-level icons representing low, medium and high, were found to be understood by most people.

### **Positioning of input and output**

The positioning of the voting tablets along the street, surrounded by other event and activities, made it obvious that the questions specifically addressed the fair. In other words, the positioning supported understanding of the intervention.

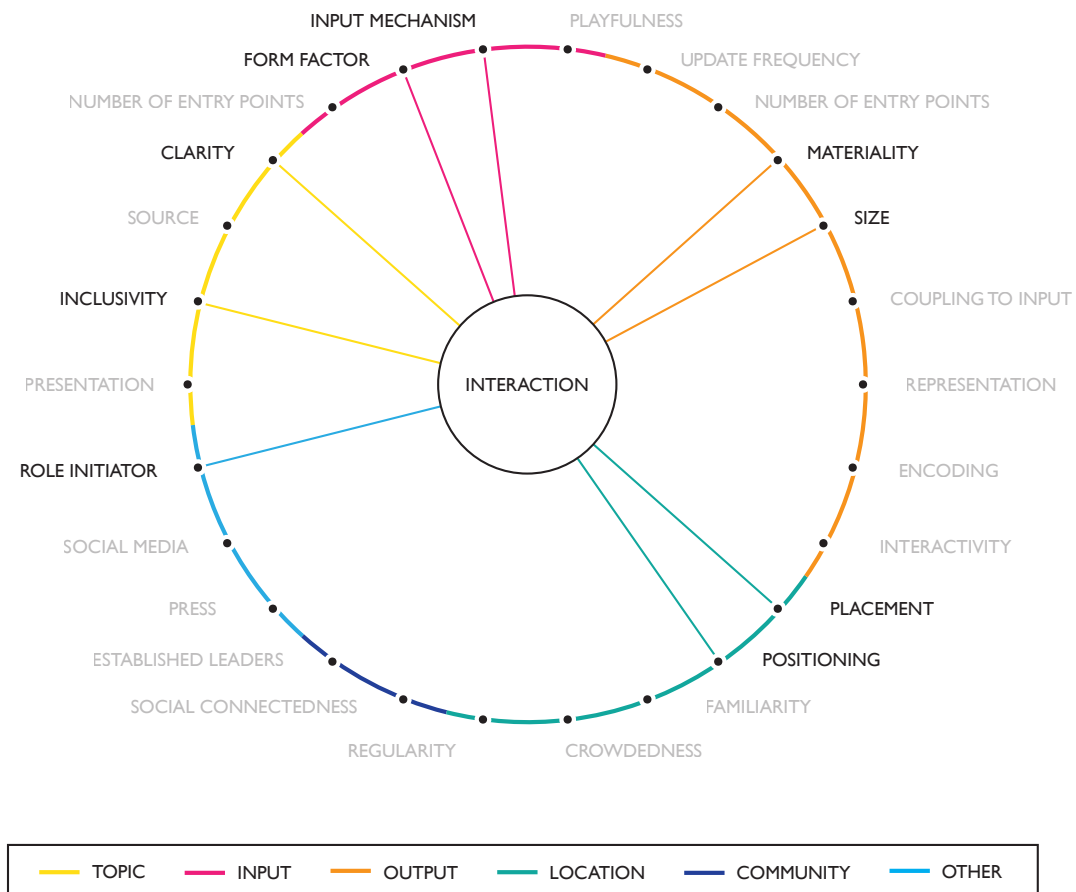
## **5.5.2.3 Interaction**

### **Inclusivity of topics**

The accessible questions made it possible for all attendees to read, understand, and answer the posed questions, regardless of whether they were familiar with the setting or not.

### **Clarity of aim**

The overall aim of the intervention was not clearly communicated through the posed questions, and as a result some people associated the intervention with council monitoring. While the researchers were able to verbally clarify this aim, this required more active involvement of the researchers.



**Figure 5.12:** Factors framework: factors relating to interaction

### Form factor of input technology

For a number of attendees, the use off-the-shelf input technology was found to evoke associations with salespeople, and as a result hindered understanding of and interactions with the project.

### Input mechanism

For those who did engage with the technology, the simple input method provided by the custom applications enabled a quick and clear method of participation. The familiar look of buttons likely played a key role in this.

### Materiality of output

The physicality of the tape and baubles with which the visualisation was created was found to attract tangible interactions. Children were regularly observed touching the visualisation in a playful manner. Furthermore, adults were observed touching the visualisation while

reading the visualisation or discussing the intervention with others, seemingly as part of interpreting the data.

**Size of output**

The large size of the visualisation enabled multiple people to touch the display at once, without interrupting one another.

**Placement**

The placement of the voting technology along the street facilitated interactions across the fair. The placement of the visualisation on the centrally located bridge also ensured that the output was highly accessible and noticeable.

**Positioning**

The positioning of the voting technology in the hands of researchers ensured that the input was mobile, which enabled researchers to take the technology to passers-by (see Role initiator). The positioning of visualisation on a vertical surface, the bridge wall, made it easy to see and reach, thus facilitating tangible interactions.

**Role initiator**

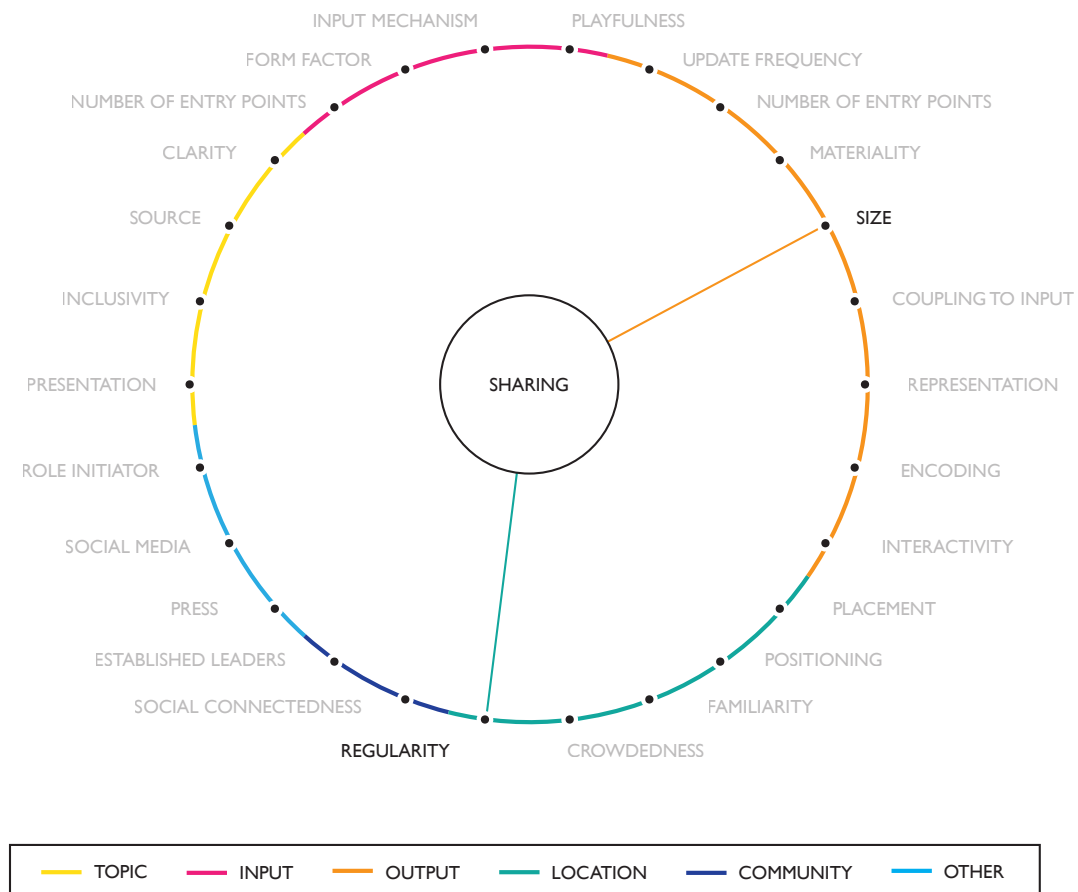
The researchers took up an active role, approaching people to encourage them to participate. This involvement was found to increase engagement, in particular interactions, as the input technology was largely unnoted otherwise.

**5.5.2.4 Sharing****Size of output**

The scale of the public visualisation enabled passers-by to point at the representations and to discuss them with people in their surroundings. The size made it possible for people to collectively view and interpret the visualisation.

**Regularity of location**

Due to the eventfulness of the fair, people were continuously presented with unusual activities and installations. As a result, the input and output received relatively low levels of attention, and few people actively engaged in sharing behaviours, such as championing or publishing.



**Figure 5.13:** Factors framework: factors relating to sharing

## 5.6 Summary

This chapter described a one-day deployment at an event in Cambridge, during which a combination of tablets, sensors, and photographs was used to collect subjective and objective data on the noisiness and crowdedness of the community fair. This data was then displayed on a large public visualisation, positioned in a central location at the event. While the intervention was successful in engaging people in some ways – with, for example, many people submitting their votes, noticing, reading, and sometimes even touching the visualisation – elements of the design were also found to act as barriers to participation. The choice of input technology was found to evoke associations with marketing and monitoring by the council, which deterred some passers-by from participating. This finding emphasises the importance of selecting appropriate input technology. Furthermore, the study showed that ambiguous terms, such as ‘noise’, can provoke discourse, as also found in the Visualising Mill Road study. In addition, the findings revealed that revisitation of either the input or output was

uncommon, likely due to the temporary nature of the event and the many other activities taking place.

The next chapter describes the design, deployment, and evaluation of the VoxBox – an installation built to collect and visualise survey-like data at events. Using the findings from the Fair Numbers study, this installation was purposely designed to attract attendees to it, rather than having to actively approach passers-by in order to encourage engagement.



## Chapter 6

# Case Study III: VoxBox

### 6.1 Introduction

Collecting data about the demographics and perceptions of people attending events is traditionally often done by conducting in-situ interviews or distributing surveys. In order to conduct interviews, organisers of events generally place several employees at strategic places at the event's site. These people will then approach attendees and depending on whether they agree to participate or not, the attendees will then be asked a series of questions. The answers to these questions can provide details about the people attending the event, as well as their opinions of the event — which organisers can use to evaluate or improve the event.

Similarly, paper surveys can be distributed at the event itself, or posted online — allowing people to provide feedback when and where it suits them. Such surveys are often conducted once the event has finished, to capture attendees conclusive thoughts about the experience.

While the two data gathering methods of interviewing people and distributing surveys have their merits, including the rich information they can collect, there is a range of disadvantages to them as well. A primary concern when gathering such data is its representativeness: to what extent do the people who have agreed to participate represent the overall demographics of attendees? Reasons not to participate include the time-consuming nature of interviews, and the fact that interviewers tend to look similar to sales people (both often wearing company clothes, badges and holding a clipboard) — which people tend to avoid. As a result, the data gathered via these interviews can be incomplete and unrepresentative. Due to the high costs of this approach, this is a very unwanted outcome. In the case of surveys, reasons

for not taking part can include the time-consuming nature of filling out a questionnaire or people forgetting about it once they have left the event. An additional reason people have little incentive to share their information, is that it often does not benefit them in any way — and the results of these data gathering practices are rarely shared with the people who took part.

As feedback about the event can be of great importance for the organisers, for whom funding often relies on the number of attendees and attendees' opinions of the event, there has been more and more exploration of alternative data gathering methods in recent years. The use of situated technology especially has been investigated as a way to replace interviews and paper surveys. While several studies have developed simple voting devices to allow people to answer one or more questions, up until now no attempts have been made at designing situated, custom technology that can fully replace an interview or survey by capturing feedback on a range of topics. In addition, little is known about how the public visualisation of such feedback can engage event attendees, by enabling them to learn more about the perceptions of other attendees.

In this chapter multiple deployments of the VoxBox are presented — a tangible installation that collects and visualises survey data at events. VoxBox was a collaboration between Connie Golsteijn, Sarah Gallacher, Lorna Wall, Sami Andberg, Yvonne Rogers, Licia Capra, and the researcher. More information about the collaboration can be found in Section 3.5.

### 6.1.1 Setting

To evaluate the use of a dedicated device to gather survey-like data, the researchers looked for an event that would attract a large number of people from diverse backgrounds. With the Tour de France starting in the United Kingdom and travelling through London, a unique opportunity arose to take part in Tour de France-related events to engage people in providing feedback. The events were predicted to attract thousands of visitors, and therefore the researchers approached the Tour de France 'fan park' organisation to inquire about the possibility of deploying the VoxBox installation during the events in London. Pitches at the various fan parks were available for rent, primarily for companies wanting to promote or sell their products and services to the thousands of people expected to visit the events. The organisation agreed to provide a 3 meter by 3 meter pitch at two fan parks in London, free

of cost. In return, they were keen to receive the feedback on the events collected via the VoxBox.

The first deployment of VoxBox took place in Green Park – a 19-hectare Royal Park in central London (UK) – during an event organised to celebrate the passing of the Tour de France through London. The park was rebranded as a ‘Tour de France Fan Park’, and provided several types of entertainment to visitors: various vans and stalls offered food, drinks, souvenirs and cycling related activities (e.g. games, photo booth with bicycle, cycling competitions). Entrance was free. The start of the Tour the France was shown on a large 42  $m^2$  public screen. While the Fan Park was open for several days, the VoxBox was only deployed on the day the Tour de France passed by the Fan Park — a Saturday. According to the organisers, approximately 10,000 people attended the event.

The second deployment of VoxBox again took place at a Tour de France Fan Park, this time at Canary Wharf (London, UK). The event was held during the final stage of the Tour de France, which was happening in France. People were able to view this final leg of the race via a large public screen (42  $m^2$ ). Vans and stalls again provided food, drinks, souvenirs and activities. This event also took place on a Saturday. According to the organisers, approximately 1,000 people attended the event.

### 6.1.2 Research objective

The specific research focus of the VoxBox study was on the use of event feedback-related topics; central input technology with a variety of input methods; and a central, real-time updated visualisations (as shown in Figure 6.1). This focus is further detailed below.

CASE STUDY	TOPIC	INPUT	OUTPUT
I: VISUALISING MILL ROAD	COMMUNITY-GENERATED	VOTING (D)	DELAYED UPDATES (D)
II: FAIR NUMBERS	ENVIRONMENTAL	VOTING (D)	REGULAR UPDATES (C)
III: VOXBOX	EVENT FEEDBACK	MIXED (C)	REAL-TIME UPDATES (C)
IV: VOXBOX REAPPROPRIATED	PERSONAL	MIXED (C)	TAKEAWAY (C)
V: SCRIBBLES, MAGNETS, TYPEWRITER	OPEN-ENDED	TEXTUAL (D)	INTERACTIVE (C)
VI: URBAN TYPEWRITER	CONSULTATION	TEXTUAL (N)	DELAYED UPDATES (N)

**Figure 6.1:** Research focus of the VoxBox case study (D = distributed, C = central, N = nomadic)

The main objective of the study was to see if an interactive installation like the VoxBox, which collects and visualises survey-like data, can engage attendees of recreational events. Key to the study was establishing if and how people at such events engage with the input and visualisations. The installation was specifically designed to explore the use of situated technology to query crowds with a survey-like series of questions about the experience of attending the event:

**VB RQ1: How does the use of topics that address the experience of an event affect engagement?**

Similar to the Fair Numbers study, the setting did not allow for community-generated topics. By instead addressing the experience of the event, the study intended to engage a wide range of people in an inclusive manner, while also collecting data of interest to event organisers.

As the installation posed a series of questions, an equal number of dedicated input methods were designed, consisting of a variety of different input mechanisms:

**VB RQ2: How does the use of multiple input mechanisms affect engagement?**

The use of a diversity of mechanisms was necessary to collect a survey-like selection of data. In addition, this diversity was also intended to provide a more playful data submission experience, by allowing people to interact in different ways.

As the regular updating process during the Fair Numbers did not succeed in creating anticipation, for the VoxBox a real-time updating process was instead investigated:

**VB RQ3: How does the use of real-time visualisations affect engagement?**

By visualising the collected data immediately, the aim was to engage people in comparing their contributions to the answers provided by others.

## 6.2 Design

### 6.2.1 Conceptual design

The VoxBox was specifically designed for short-term recreational events, making the ability to easily transport the installation to different events a key feature. For this reason, the

VoxBox had to be modular. By allowing all components to be removed and replaced easily, transportation and customisation could be done quickly. Furthermore, the VoxBox was designed to function as a traditional survey. A series of both open and closed questions were composed, addressing various aspects of the experience of attending an event. All questions were designed to be easily replaceable, to allow for customisation at different types of events. In addition, the installation was meant to attract people to it, to avoid the need for active recruitment of participants. For this reason, the VoxBox had to be large and eye-catching in order to stand out at events. Similarly, it had to be accessible to people of all ages, and was thus designed to be simple, intuitive and self-explanatory. A key component was the real-time visualisation of the data gathered via the VoxBox. Seeing as such an open approach to gathering and sharing data is rare in traditional opinion gathering methods, this real-time visualisation offers a unique insight into the demographics and views of others — for all to see.

### 6.2.2 Topics

The questions posed via the VoxBox were defined by the team of researchers. The main objective was to mimic the types of questions typically addressed via surveys. It was therefore decided to include questions relating to four categories:

- Demographics: questions related to the participant's characteristics
- Mood: questions related to how the participant feels
- Crowd: questions related to the participant's perception of the other attendees
- Event: questions related to the participant's perception of the event

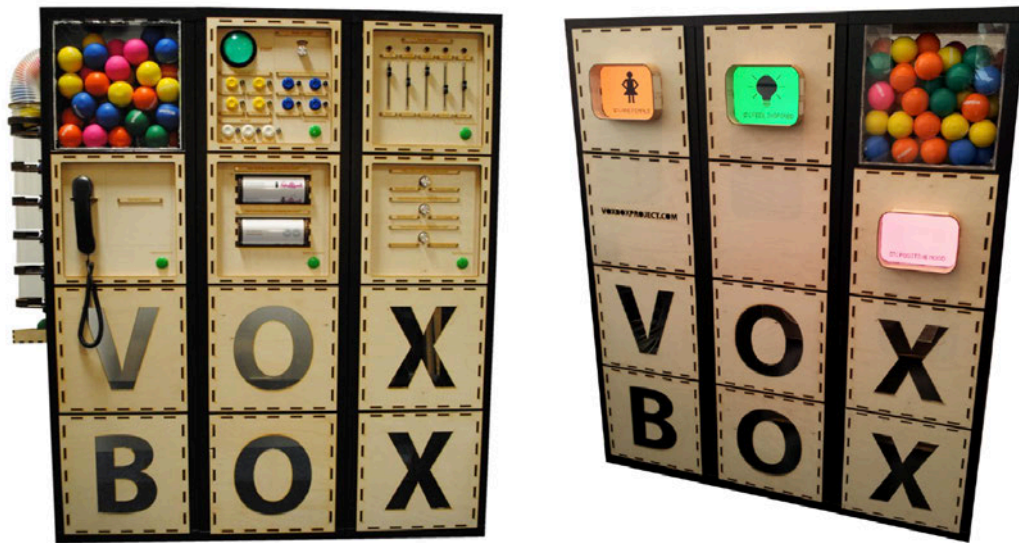
Each of the four categories contained 2 to 5 questions. For example, the demographics category consisted of four questions, addressing age, sex, place of residence, and the people the participant was visiting the event with. An overview of all questions can be found in Table 6.1.

Similar to typical surveys, many of the questions were multiple choice questions, offering people a selection of pre-defined answers to choose from. For example, when asked about the experience provided by the event, five options were provided: negative / somewhat negative / neither negative nor positive / somewhat positive / positive. Several other questions

Demographics			
1	What is your age?	0-24; 25-44; 45-64; 65-74; 75+	Rotary knob
2	Where do you live?	Greater London; nearby county; different part of the UK; outside the UK	Button
3	With whom are you visiting this event?	Alone; partner or family; friends; other	Button
4	Are you?	Female, male, other	Button
Mood			
5	Excited - bored	Continuous scale	Slider
6	Surprised - unsurprised	Continuous scale	Slider
7	Welcome - unwelcome	Continuous scale	Slider
8	Inspired - indifferent	Continuous scale	Slider
9	Safe - unsafe	Continuous scale	Slider
Crowd			
10	What is the current mood of the crowd?	Continuous scale (The mood is negative - the mood is positive)	Rotary knob
11	How well do you feel you fit in with the crowd?	Continuous scale (I don't fit in at all - I fit in completely)	Rotary knob
12	How connected do you feel to the crowd?	Continuous scale (I don't feel connected at all - I feel strongly connected)	Rotary knob
Event			
13	How much do you feel part of this event?	I feel excluded from this event; somewhat excluded; neither excluded nor a part; somewhat a part; a part of this event	Physical spinner
14	How is the experience provided by this event?	The experience is negative; somewhat negative; neither negative nor positive; somewhat positive; positive	Physical spinner
15	a) If there was an entry fee for this event, how much would you be willing to pay? b) What will you most remember about this event? c) How would you describe this event to a friend? d) If the organisers could change one thing about this event, what would that be?	Open question	Phone

**Table 6.1:** VoxBox questions, answer options, and input methods

addressed topics with less obvious answer categories. Therefore, the decision was made to include continuous scales, enabling people to position their answer along a scale (e.g. from



**Figure 6.2:** VoxBox front and rear

feeling completely safe to feeling completely unsafe). Finally, an additional open-ended question was added to allow people to also provide qualitative feedback about the event. The questions were posed in order from personal to increasingly external, starting with demographics and personal mood, followed by perceptions of the crowd and the event.

### 6.2.3 Input technology design

The input technology was designed by Connie Golsteijn and Sarah Gallacher. More information about the collaboration can be found in Section 3.5.

While the VoxBox's modularity was important in order to make it easy to transport, both the hardware and software also had to be robust enough to withstand continuous use. For this reason, three off-the-shelf IKEA shelving units were used as the frame of the installation. All shelf openings were then used to slot in modular components containing different input technologies. By keeping this slotting mechanism modular, the order of questions could be changed easily between events. Similarly, individual modules could be replaced and reconnected with little effort.

All modules were created using laser cut plywood, with custom openings for the different input technologies. A selection of colourful, eye-catching off-the-shelf buttons, sliders and spinners were used for the different questions, to provide a playful variety of interactions

during the answering process. In addition, a phone handset was included to ask a final open question.

The modules were ordered by theme, starting with multiple choice questions and ending with an open-ended question. LED strips around the modules turned on in sequence to communicate to people which module they were supposed to fill out. A large green lit-up button was placed in the first module, to indicate where the survey started. Upon pressing this button, the VoxBox would activate the first module. For the multiple choice questions, a range of off-the-shelf buttons, including rotary knobs, sliders, and spinners, were used to address all types of questions. In addition, it was hoped that the use of a variety input methods would make the experience of answering multiple questions more enjoyable. LED lights next to each input mechanism provided feedback about the selected answers, allowing people to see and adjust their answers before submission. For the open question, a telephone handset was used to mimic the experience of receiving and answering a phone call. Answering the final multiple choice questions would trigger the sound of a phone ringing, and once someone would pick up the handset a randomly selected pre-recorded audio message would ask the final question. An audio recorder stored all answers.

All questions and answer options were etched into plywood to create labels, which were screwed onto the VoxBox, above the corresponding input technology. All technology was connected to open source Arduino micro controller boards. To ensure modularity, one board was used per module — allowing for the replacement of components. The different boards were then connected to a ‘Master’ Arduino board, controlling the sequence of the modules, WiFi and the connection to the database.

To provide an additional incentive for people to take part in answering a survey via the VoxBox, a ‘takeaway’ was included: a colourful stress ball with the VoxBox URL. Instead of presenting the stress ball at the end of the survey, it was used as a way to show progress. A tube at the left side of the VoxBox showed the ball falling down further and further upon the completion of each module (see Figure 6.2). This process was implemented using six different servo motors with plywood arms holding the ball in place. Once all questions were answered, the stress ball would drop into an open plywood tray, to allow the participant to pick it up and take it away.





Figure 6.3: VoxBox visualisations

#### 6.2.4 Choice of input technology locations

As the organiser of both events offered to provide a pitch, free of cost, at an event otherwise occupied by organisations who paid to take part, it was not immediately clear if the researchers would have any influence on the location of the allocated pitch. Nevertheless, the researchers expressed a preference for locations along the main walkway – to ensure many people would come across the VoxBox.

During Event 1, the VoxBox was placed near one of the entrances to the event, with the input side facing the main walkway. The exact positioning of the VoxBox was imposed by the organisers, who wanted to prevent people from walking behind the gazebos, where different power generators were placed, and because of this the VoxBox could not be rotated. A section of grass between the VoxBox and the walkway allowed people to look at and interact with the VoxBox without obstructing the path.

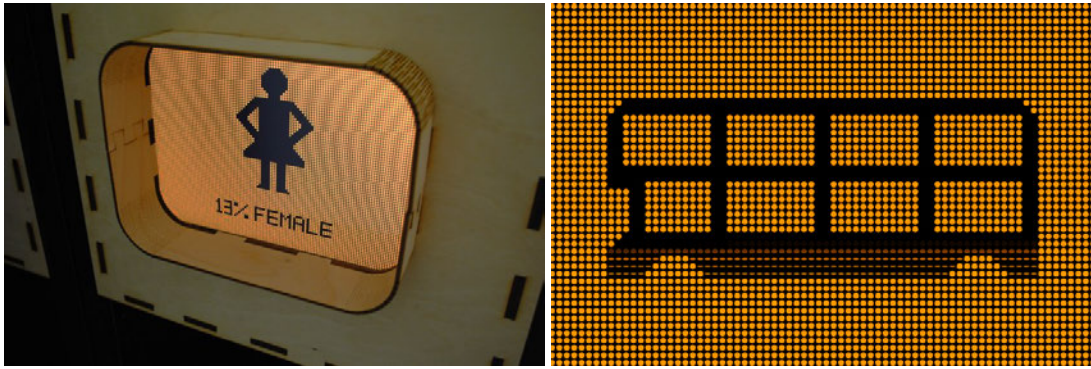
During Event 2, the VoxBox was placed under a higher gazebo, and was placed perpendicular to the main walkway, allowing people to view both the input and output side when walking past. The space between the VoxBox and the walkway allowed people to look at and interact with the VoxBox without obstructing the path of those walking past. During this second event, the organisers did not impose restrictions on the positioning.

### 6.2.5 Visualisation design

The VoxBox was designed to not only allow people to share data on their own views, but to also give them the opportunity to learn more about the opinions held by others. To enable passers-by to view and discuss the data gathered at the front side of the VoxBox, colourful, simple visual representations of the collected data were shown at the back of the installation. To ensure the aesthetics of these representations would match the look and feel of the input technology, inspiration was sought from retro display technology: flip-disc displays, the electromechanical dot matrix displays traditionally used for destination signs on buses. While these signs are originally of ultra low resolution, re-creating digital screen-based flip-disc displays allowed for the display of higher resolution infographic-like visualisations. By flipping the discs row by row, the display scrolled through different real-time visual summaries of the data. By creating side panels around these digital screens, the intention was to create the illusion of a porthole via which people could look into the VoxBox (see Figure 6.4). Apart from protecting the screens from direct sunlight, the portholes were also designed to spark curiosity and lure people to the screens — thereby overcoming common display blindness Müller et al. (2009).

A total of three screens at the rear showed visualisations of a selection of the questions asked at the front side. Multiple screens were used to allow multiple people to read the visualisations simultaneously without getting in one another's way. In the initial version, used at the first event, the three screens all rotated between a selection of answers to four question. One screen showed the answers related to demographics (percentage female, percentage from London, percentage under 25 and percentage of people who are attending the event with friends), and the two other screens showed answers related to mood and crowd (percentage in a good mood, percentage bored, percentage who do not fit in, percentage feeling inspired and percentage feeling safe).

In the following version, used at the second event, some adjustments were made to the visualisations. The rotation was sped up to show the different visualisations in quicker succession: the initial refresh rate of 5 seconds was changed to 3 seconds. In addition, one screen was now completely dedicated to the answers given via the telephone handset to the open questions. Instead of a visual representation, this screen showed short quotes.



**Figure 6.4:** Left: VoxBox visualisation porthole. Right: detail of updating process; the dots are flipped row by row.

### 6.2.6 Choice of visualisation location

The VoxBox was designed to act as a stand-alone dedicated device for collecting and displaying feedback on the event. For that reason, the visualisations were displayed on the same installation as the input technology. The use of off-the-shelf IKEA shelving units provided the ability to slot in modules at both the front and rear. Therefore, the choice was made to use the front to collect feedback, and the back to display aggregates of the collected data in real-time. By making use of both sides of the installation, the idea was that different people could provide feedback and look at the data simultaneously without interrupting one another. Furthermore, people who had provided feedback would be able to walk to the back once they had finished submitting their input in order to see how their views compared to those of the other attendees.

## 6.3 In-the-wild study design

The VoxBox was deployed at two events, one at the start and one at the end of the annual Tour de France bicycling race. At both events, the VoxBox was placed under a gazebo on an allocated pitch in between other gazebos and stalls offering different types of activities, merchandise, and food. Access to the pitch was provided early in the morning, allowing the researchers to transport the shelves and modules to the site. The following hour was used to put together the gazebo and VoxBox. A black chalkboard sandwich sign was placed in front of the gazebo, with a message inviting people to use the VoxBox (*"VoxBox - Share your views here"*). Three different video cameras were placed around the VoxBox, to capture all interactions. Signs explaining the research and informing people they were being recorded





**Figure 6.5:** Set-up at Green Park

were attached in different places around the gazebo. Throughout the day, a team of 3 to 5 researchers was present near the VoxBox. These researchers conducted observations and assisted people who needed help with using the VoxBox, or asked questions about it.

A mixed method approach was adopted to analyse interactions with the VoxBox, and the following data was collected: (i) logged votes from the VoxBox; (ii) observations in situ, captured in field notes; (iii) video recordings of both the input and visualisation side. The video recordings were transcribed by the researcher to identify who engaged with the input side and visualisation side, when, and how they interacted.

## 6.4 Findings

The VoxBox was deployed at event 1 and event 2 for 6 hours each. During these events, the installation successfully attracted people, many of whom engaged with the device and answered the questions. In the following sections, the types of engagement with the installation, and the aspects of the design that did and did not work are described in detail.

### 6.4.1 Curiosity

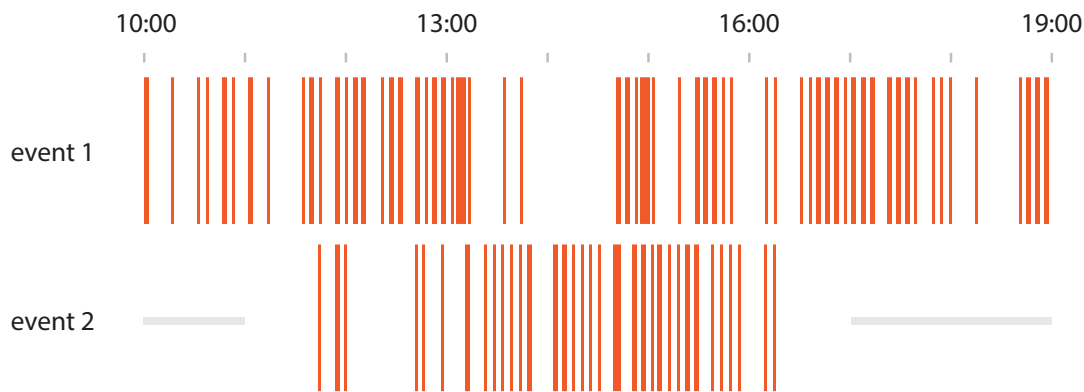
One of the objectives was to find out if a device like the VoxBox can attract people in a natural manner, instead of the device's facilitators having to actively recruit people to fill out the survey. Therefore, the researchers attempted to stay in the background during both deployments. While they were available to answer any questions or help people with using the VoxBox, they did not shepherd people towards the VoxBox. Instead, all individuals and groups who approached the VoxBox did so because they had noticed the device while walking past, and chose to have a closer look.

At event 1, around 60 people walked past the VoxBox per minute. Video analysis revealed approximately 1% of passers-by approached the VoxBox. At times, this resulted in people having to queue while waiting for their turn to interact with the device. At event 2, which was much quieter, around 3 people walked past the VoxBox per minute, of whom approximately 10% approached the VoxBox. It should be noted that the pace at the two events differed greatly. At event 1, the constant stream of people made it harder for people to take the time to look around, as standing still or decreasing pace on the main walkway would block the road. At event 2, however, the low number of attendees ensured that those present were able to leisurely explore the various stalls.

### 6.4.2 Interactions

At both events, people generally approached the VoxBox in groups — with one person leading both the approach and the interaction while the others followed, observed and often joined in. At event 1, 96 sessions took place, during which groups or individuals filled out the VoxBox, making up a total of 181 people (group size:  $\mu = 1.9$ ). Of those, 39 filled out the VoxBox alone (40.6%). At event 2, 33 sessions took place during which groups or individuals filled out the VoxBox, making up a total of 79 people (group size:  $\mu = 2.4$ ). Of those, 8 people filled out the VoxBox alone (24.2%). During the deployments, no one required assistance with interpreting or answering the questions. Most children were able to understand the meaning of the questions independently.

Filling out the VoxBox took people an average of 2 minutes and 22 seconds at event 1 ( $\sigma = 1$  minutes and 35 seconds). It took people at event 2 a similar amount of time, with an average of 2 minutes and 44 seconds ( $\sigma = 1$  minute and 35 seconds).



**Figure 6.6:** Submission times at event 1 and event 2

At event 1, 109 entries were submitted via the VoxBox, with an average filling out time of 2 minutes and 22 seconds. This means that the VoxBox was occupied for approximately 4 hours and 18 minutes — 71.7% of the deployment time. At event 2, 41 entries were submitted via the VoxBox. The average filling out time of 2 minutes and 44 seconds means the VoxBox was occupied for approximately 1 hour and 52 minutes — 31.1% of the deployment time. Interactions took place throughout the day, as shown in Figure 6.6. Despite the relatively passive role of the researchers at both events, almost all people completed the VoxBox fully before leaving. In total only 4 people left prematurely.

At the two deployments, problems with using the VoxBox occurred occasionally. While the majority of people were able to complete all questions without any help, several people needed to be directed towards the large green ‘start’ button, which activated the first unit. Similarly, not all people pressed the ‘submit’ button after completing the individual units. As omitting this did not activate the lights in the successive unit, most people quickly realised what had happened and managed to proceed without additional guidance. Furthermore, the order in which to complete the units was not clear to everyone, and while the lights in each module were meant to guide people — these lights turned out to be difficult to see in direct sunlight. Sunlight also made it hard to view the visualisations at certain times during event 1 — as the gazebo did not shield the VoxBox completely. While some people overcame this problem by folding their hands around the visualisations to form a sun-protected porthole, others walked away only briefly after arriving at the output side.

Although interactions with the VoxBox were largely without problems, there were several issues. The starting point of the VoxBox was not clear to everyone, and because of that it

took several people a moment to figure out where to begin. Sunlight played an important role in this, as the LED strips around the modules and inside the large start button proved difficult to see in bright light. This also caused problems when people progressed through the different modules, as the lack of lights made it harder to see in which order the modules had to be answered. Furthermore, not all functionality of the device was discovered by all people. The ball tube on the left, which was designed to display progress to incentivise people to fill out all question, was often only noticed upon completion of the VoxBox. Similarly, due to the positioning of the device, many people did not discover the visualisations on the rear.

The input methods for the multiple choice questions – including the buttons, knobs, sliders, and spinners – were found to be intuitive for people of all ages. The input method for the open-ended questions, however, caused confusion for many. While everyone understood that they had to pick up the phone when it rang, the pre-recorded automatic message surprised people. Many picked up the phone by saying ‘hello’, as one would do with a normal phone, and especially children expected someone to talk to them directly. Instead, the automated message would ask them to answer the question after the beep. Many children did not know what to do, and instead handed the phone to their parents – who in turn only heard silence once they took over the phone. Those who did leave a message were often unsure of what to do when they had finished talking, as the VoxBox did not give any feedback that indicated their message had been recorded.

Both the qualitative and quantitative data gathered during the events suggests that the process of participating was an enjoyable experience for many people. The high completion rate indicates that the experience was enjoyable enough for people to answer all questions. In addition, the completion times and observations at both events showed that people took the time to read, consider and sometimes even discuss the questions before answering, suggesting they found the process enjoyable enough to carefully consider their answers. Video analysis of the interactions revealed that individuals and groups spent up to 14 minutes completing the VoxBox. Thirdly, observations, video analysis, and comments from VoxBox users revealed that many people expressed that they were enjoying the experience of participating — remarking “*oh my goodness this is so cool*” and “*it is something really fun but it is useful and collects data too. It doesn’t take too long and it’s like a game. If you came up [to me] with a questionnaire, I’d run away!*”.

The variety of input controls, ranging from arcade buttons to spinners, also made people look forward to filling out the upcoming modules (e.g. *“I can’t wait for this bit”* [points at spinners]). Several people described how the process of answering the various questions made them feel *“in the zone”* and *“in my own bubble”*, with the event *“fading into the background”*. Furthermore, people described that the VoxBox reminded them of other playful devices, describing the installation as *“some kind of fairground automata”*, *“a Willy Wonka machine”* and something resembling *“the controls of the Tardis”*.

### 6.4.3 Collaboration

At both events, the process of filling out the VoxBox was frequently done in groups, often with one person leading the interaction by reading the questions out loud. For example, a woman in one of the groups actively tried to involve everyone by posing the questions to the other people in her company in their native language and encouraging them to *“come closer!”*

Occasionally, group collaborations led to multiple people pressing buttons simultaneously, thereby interrupting one another. One mother, for example, told her young daughter off for pressing the submit button before she had finished answering the questions — and they then agreed that the daughter was allowed to press the submit buttons, but only when her mother indicated that she could do so. Several other families collaborated in a similar fashion, with one of the adults reading the questions out loud and guiding their children on how to answer them, while the children did the actual pressing of the buttons (e.g. mother exclaiming *“oh, [you] answer the phone!”* once it started ringing, father asking toddler *“do you want to answer the phone?”*, father to child: *“watch the ball [go down], that’s your ball”*, mother to child: *“Here, push this [button]”*).

Disagreements on who was supposed to do what took place in various groups. For example, after a young girl kept pressing buttons repeatedly, one of the other children she arrived with told her *“I’ll do it, I’ll do it! Stop, go away!”*. Others worked more collaboratively, discussing their perceptions of the event by asking one another questions. For example:

[couple approach VoxBox, woman takes lead and interacts with device]

Woman: *“Are you excited?”*

Man: *“Always excited”*.



Woman: *"Thank you, [name of man]. You're too positive".*

[Woman submits vote]

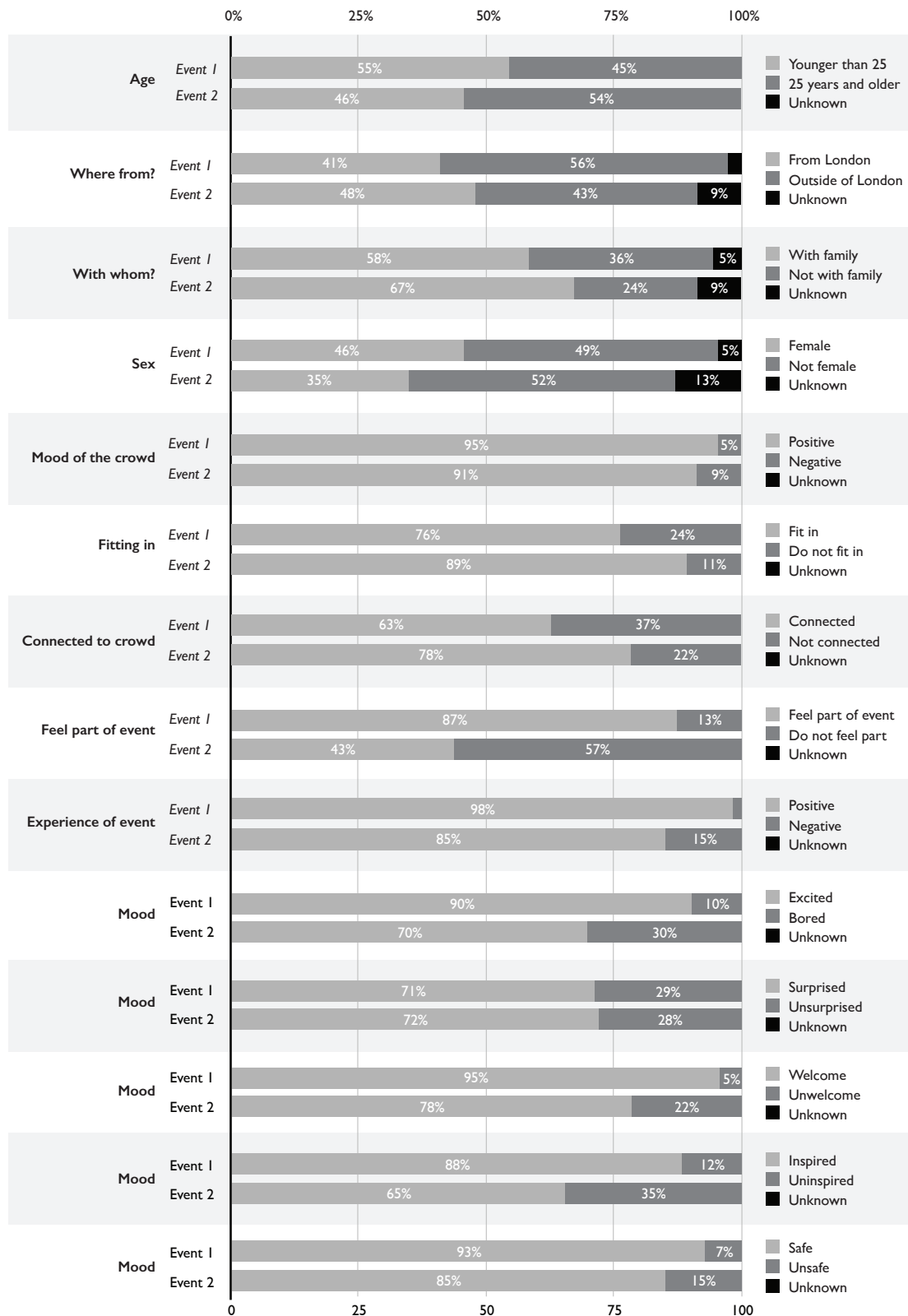
While in the majority of cases verbal agreements were made, one woman was observed using her husband's arm to answer a question by silently steering it in a specific direction with her own hand.

#### 6.4.4 Contributions

During event 1, 109 survey entries were submitted via the VoxBox. An overview of these entries can be found in Figure 6.7. The survey data reveals that the majority of people interacting with the VoxBox at this event were from outside London (56.4%). Many were younger than 25 (54.5%). Most attended the event with family (58.2%). 51 were female (46.4%), 50 male (45.5%), and 4 people (3.6%) answered with 'other'. The answers to this final question approximate the findings from the video analysis. The open questions posed via the telephone were answered in 91 instances, with 77 of those answers containing the information asked for (70%). The vast majority of irrelevant answers were given by children under the age of 10, who were often unsure about how to proceed when the telephone rang. Attitudes towards the event were largely positive, with 98.2% of the entries describing the event as a positive experience. The majority felt they fitted in (76.4%), and felt they connected to the crowd (62.7%).

During event 2, 41 survey entries were submitted via the VoxBox, of which an overview can be found in Figure 6.7. This data reveals 43.5% of people visited the event from outside of London. Most were 25 years or older (54.3%). The majority of people visited the event with family members (67.4%). 16 were female (34.8%) and 24 male (52.2%). The open questions posed via the telephone were answered in 32 instances, with 26 of those answers containing the information asked for (72.7%). Again, irrelevant answers were primarily provided by young children. Attitudes towards the event were again largely positive, with 84.8% of the entries describing the event as a positive experience. A majority of 89.1% felt they fitted in, and 78.3% felt connected to the crowd. However, a majority of 56.5% did not feel part of the event.

Finally, the open question posed via the telephone allowed attendees to provide feedback on several components of the event. A thematic analysis of these replies revealed that similar



**Figure 6.7:** Overview of distribution of votes per question at event 1 ( $n = 110$ ) and event 2 ( $n = 46$ )

themes and answers were provided at both events, showing no major differences in the types of replies. A sample of the answers given at the two events is presented below:

VoxBox: *“What does cycling mean to you?”*

[event 1] Young boy: *“Racing”*.

[event 1] Young girl: *“I think cycling is an amazing part of fitness and it also brings together lots of countries in the world”*.

[event 1] Woman: *“Wind in my hair, and getting somewhere faster than I would otherwise — comfortably”*.

[event 1] Man: *“Fun, fresh air and excitement”*.

[event 1] Young boy: *“It means getting healthy”*.

[event 2] Woman: *“Freedom”*.

[event 2] Man: *“A nice way of getting from A to B”*.

[event 2] Man: *“Health and fitness”*.

VoxBox: *“How would you describe this event to a friend?”*

[event 1] Woman: *“Looks like it’s going to be amazing. We’re here early on but it’s already packed with lots of people. There’s tons of food vendors, lots of flags, a big screen TV, it’s going to be great”*.

[event 1] Young boy: *“Cool”*.

[event 1] Man: *“Massive, crazy and fun”*.

[event 2] Woman: *“Very hot, with lots of food [laughs]”*.

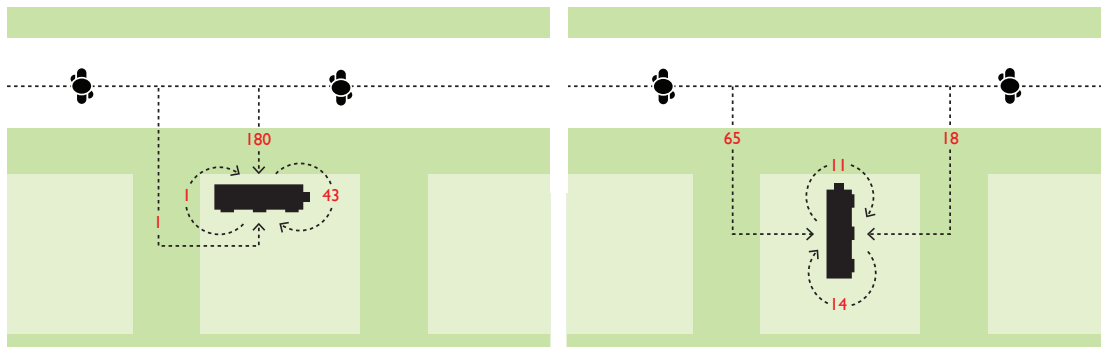
[event 2] Man: *“Exciting”*.

[event 2] Woman: *“Lively”*.

#### 6.4.5 Viewings

Due to restrictions on the positioning of the VoxBox at event 1, the visualisations were not visible from the main walkway. It quickly became apparent that people did not realise there was more to the installation than just the front side. The researchers decided to take up a more active role, by shepherding people to the output side to show them the visualisations. Of the 20 sessions during which individuals and groups looked at the visualisations, 18 sessions (90%) were shepherded by the researchers — generally after they had completed

the input side. The other two instances occurred more naturally. One couple walked up to the visualisations after having seen others standing at the rear of the VoxBox. Another woman noticed the visualisations while seeking shelter from the rain underneath the VoxBox gazebo. The latter was also the only instance of someone viewing the visualisations before seeing the input side of VoxBox. Of the total of 181 people approaching the VoxBox at event 1, 44 viewed the visualisations (24.3%). An overview of the different ways in which people approached the visualisations can be found in Figure 6.8.



**Figure 6.8:** Approaches to front and rear of VoxBox, left: setting at event 1 (Green Park), right: setting at event 2 (Canary Wharf)

At event 2, the VoxBox was positioned perpendicular to the walkway, allowing people to view and approach the VoxBox from either the front or the rear. The shepherding of people from the input to the output side was therefore no longer necessary. Of the 16 sessions during which individuals and groups viewed the visualisations, only 3 sessions (18.8%) were initiated by the researchers. In all other instances, people approached the visualisations without having been prompted — generally because they noticed the back of the VoxBox while walking past. Of the total of 83 people who approached the VoxBox, 29 viewed the visualisations (34.9%). In total, 18 people approached the visualisations directly (21.7%).

At event 1, there were 20 sessions during which individuals and groups looked at the visualisations, making up a total of 44 people (group size:  $\mu = 2.2$ ). Of these, 23 were female (52.3%) and 21 male (47.7%). A majority of 27 people were adults, and the remaining 17 were children and teenagers.

At event 2, there were 16 unique sessions of individuals or groups looking at the visualisations, making up a total of 29 people (group size:  $\mu = 1.8$ ). Of these, 14 were female (48.2%) and 15 male (51.7%). A majority of 26 people were adults, and the remaining 3 were children and teenagers.



**Figure 6.9:** Interactions with the visualisations

On average, people at event 1 looked at the visualisations for 35.9 seconds ( $\sigma = 28.6$  seconds). At event 2, however, people looked at the visualisations for 20.1 seconds on average ( $\sigma = 25.6$ ). As the three displays at event 1 scrolled through four different visualisations each every 10 seconds, viewing all visualisations would require at least 40 seconds — assuming someone was able to look at all three displays simultaneously. At event 2, the refresh rate was increased, meaning the viewing of all visualisations took at least 32 seconds — again assuming simultaneous viewing. Observations and video analysis revealed that the vast majority of people did not wait to see all visualisations. Instead, most people briefly glanced at one or two of the displays (generally the two screens positioned high on the VoxBox) and left shortly afterwards. Two aspects of the design likely affected engagement with the visualisations: glare and the height of the screens. Despite efforts to improve the visibility of the screens by creating portholes, bright sunlight still obstructed people from seeing the visualisations clearly. Furthermore, due to the relatively low height of the screens, the portholes obstructed the view from above, which meant tall people had to bend down to view the displays.

When looking at the visualisations in groups, people were observed pointing at the different displays to encourage the people in their company to look at that specific visualisation (see Figure 6.9). During event 1, such pointing occurred during 7 out of 20 sessions (35%), and event 2 it was observed in 2 out of 16 sessions (12.5%). This behaviour was particularly common when people discussed one or more specific visualisations.

#### 6.4.6 Discourse

While viewing the visualisations, several people attempted to interpret the data by discussing it with others in their group. Their comments can be roughly divided into two groups: those who were convinced the data presented their personal answers (i.e. we just filled out

the VoxBox and can now see the results) and those who understood that the data presented aggregate answers (i.e. it shows data from all people who filled out the VoxBox).

The former interpretation led to various misunderstandings between people. For example, a group of 4 children (2 female, 2 male) viewed the visualisations for a relatively long period of time at event 1 (1 minute and 33 seconds), after one of them had filled out the VoxBox survey. They briefly discussed the results shown on the screens:

Girl 1: *"You can see how everyone's filled it in".*

Girl 2: *"28% are from London".*

Boy 1: *"Do you not fit in? You don't feel that you fit in?"*.

Boy 2: *"What?"*.

Boy 1: *"It said on the back. You didn't feel like you fat [sic] in".*

This exchange shows that Boy 1 thought the visualisations showed Boy 2's answers and as a result he decided to confront Boy 2 with the answer and ask him why he voted in this manner. Similarly, one woman looked at the visualisation showing data related to how bored people felt and exclaimed *"No, I said I was excited. I am not bored!"* — thinking the visualisation showed her personal data. One man initially exclaimed *"It's not me!"* when looking at the visualisations, before concluding only aggregate data was shown: *"Is that me? Ah! That is not my personal [data]"*.

The majority of people did realise that the visualisations showed aggregate data. Responses to the data differed, with several people not discussing it at all and others commenting on it briefly. The visualisations did not evoke conversations or discussions beyond a handful of comments. Frequently longer conversations took place in group interactions, where one or more people would read the data out loud — often while pointing at the visualisation in question. For example:

[Four adult men approach VoxBox at event 1]

Man 1: *"93% feel safe... 51% are under 25".*

Man 2: *"[inaudable percentage] don't fit in... they don't fit in, [then] go home! Can't believe it."*

Man 1: *"96% positive".*

Man 3: *"Yeah, yeah".*

Man 1: *"44% female... that's more female... [does not finish sentence]"*.

Man 2: *"Which question was that?"*

Man 1: *"Male or female... wonder how many said 'other'"*.

These conversations generally contained little to no sense-making of the meaning behind the data. Mostly, people read the results, commented on it briefly and then moved on. For example:

Man: *"Oh, 9% feel bored, that's pretty high"*.

[woman does not respond]

Man: *"Only 33% from London. We're not from London, we're from [other city]"*.

[both leave]

At event 1, the researchers made a handful of attempts at engaging people in more extensive conversation and reflection on the data by probing people to think about the meaning behind the data. These attempts did not successfully trigger any discussions. An example of this is shown below:

Researcher: *"18% came with friends"*.

Woman: *"18%? Is that it?"*

Researcher: *"Yes, maybe many came with family?"*

Man: *"96% feel safe"*.

Woman: *"Why would you not feel safe?"*

[they then talk to the researchers about the VoxBox, they do not look at visualisations anymore, and eventually they walk away].

The visualisations about boredom, safety, the percentage of people from London and the percentage of females evoked most comments.

Overall, the installation was not found to promote revisitation, and most people only took part once. The few people who were observed returning to the VoxBox were young children, who appeared to either enjoy the process of using the different input mechanisms, or who wanted another stress ball. No one was observed returning to the visualisations.

## 6.5 Discussion

The objective of the VoxBox study was to investigate how people at events would engage with a situated device designed to collect and visualise survey-like data. The findings show that the level of engagement with the VoxBox was varied: while the input technology attracted many people, many of whom also submitted data, the visualisations were far less successful in engaging people.

### **VB RQ1: How does the use of topics that address the experience of an event affect engagement?**

The aim of using topics related to the event experience was to create an inclusive installation that could be used by people from a wide range of backgrounds and ages. The deployments showed that the VoxBox indeed managed to engage a diversity of people. While young children often required help from an adult to understand the posed questions, all other attendees were found to be able to comprehend and answer the topics independently.

The questions posed via the VoxBox queried people on a range of topics related to the events, and the high completion rate of the VoxBox suggests that the selection of 15 questions was appropriate: engaging people for long enough to collect opinions on multiple topics, while ensuring they were able to finish the survey. Furthermore, the accessible nature of the topics, which did not require any pre-existing knowledge and only addressed personal perceptions of the event, successfully enabled the participation of people from a range of ages and backgrounds. These findings show that publicly collecting perceptions using situated technology not only works when multiple questions are posed over time (e.g. Steinberger et al. (2014); Taylor et al. (2012), and Visualising Mill Road), but also when multiple questions are posed concurrently as part of one interaction session.

The questions themselves, however, did not provoke discourse beyond simple decision making conversations. Several aspects of the deployment may have affected this lack of in-depth discourse, such as the crowdedness at the events which may have hindered focused discussion from taking place. Furthermore, unlike some of the questions in the Visualising Mill Road study (4), which made use of ambiguity to leave space for interpretation (Gaver et al., 2003), the VoxBox questions and answer options were completely unambiguous by design – to mimic typical surveys. The clarity of the phrasing of the questions and answers likely



reduced the need, or even potential, to discuss them. This reveals a trade-off between topics that provoke discourse through ambiguity, and topics that elicit highly specific answers through semantic clarity. Depending on the aim of the deployment, a balance may have to be found between the importance of situated discourse and the specificity of the collected data.

**VB RQ2: How does the use of multiple input mechanisms affect engagement?**

The use of a multiple input mechanisms was designed to collect different types of data, with the aim of also creating a more playful data submission experience. Findings from the deployments revealed that participants indeed found the interaction process enjoyable. The high completion rate further confirms that people did not interrupt or prematurely abandon their submissions while answering the series of questions. Observations of people in the process of submitting their opinions also showed that the diversity of input mechanisms made people look forward to answering the upcoming questions – as progressing through the questions enabled them to interact with the different mechanisms. Furthermore, the aesthetic provided by the variety of input mechanisms was found to catch the eye of passers-by, attracting people to the installation.

Although the deployments revealed several usability problems with the phone set, in particular a lack of feedback, the other input methods all successfully collected data on the experience of the event. These findings show that the use of multiple input methods can evoke curiosity and excitement, while offering familiarity and a tool for communicating serious feedback. Therefore, these findings extend previous work on publicly collecting data through playful devices which typically made use of only one input method, such as a keypad (Fischer et al., 2013), voting buttons (Taylor et al., 2012), or telephone (Whittle et al., 2010), by showing that the use of multiple methods can successfully support the collection of data on a range of topics. Furthermore, the findings demonstrate that a novel and playful dedicated feedback device can organically attract people at events, many of whom are even willing to queue in order to participate. This is in stark contrast with the amount of effort required to get people to participate in traditional paper surveys or interviews, revealing the potential for situated technology that makes serious participation into an enjoyable activity.

**VB RQ3: How does the use of real-time visualisations affect engagement?**

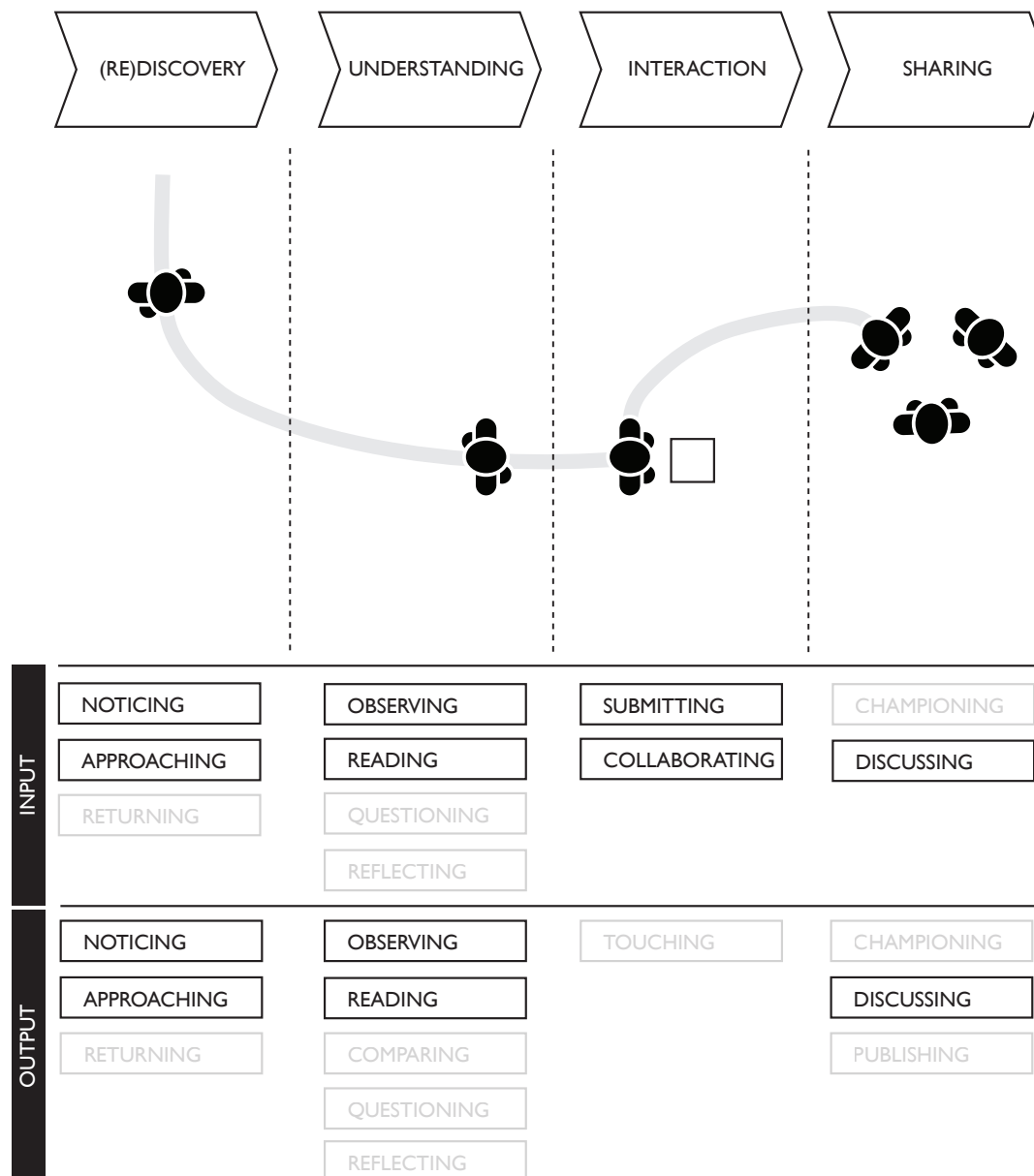
The objective of displaying the collected data in real-time was to engage people in comparing their contributions to the answers provided by others. However, findings from the study revealed that overall engagement with the visualisations was low – primarily because people did not discover the visualisations due to their positioning at the back of the VoxBox. Those who did notice the visualisations typically looked at the displays for short periods of time. The real-time updating process was generally not noticed, and was not found to affect overall engagement in any way. This lack of effect was likely at least partly due to the other design factors that hindered engagement, which are discussed in more detail in Section 6.5.2.

### 6.5.1 Types of engagement

The VoxBox deployments, again, confirmed that people experienced different stages of engagement. Within these stages, different types of engagement behaviour were observed, as shown in Figure 6.10.

In the discovery stage, people **noticed** the VoxBox and its colourful selection of input mechanisms. While the discovery of the input side of the VoxBox did not require active involvement of the researcher or other champions, the visualisation side required more active shepherding – as it was often not noticed. This improved, however, after adjustments were made to the positioning of the VoxBox during the second event, after which people did notice the visualisations without the involvement of the researchers. Upon noticing the installation, many people **approached** the device. Unlike the Visualising Mill Road study, but like the Fair Numbers study, rediscovery of the device occurred only occasionally. During the few times rediscovery did occur, only the input side was revisited.

In the understanding stage, people **observed** how others interacted with the VoxBox, to learn more about the aim of the installation, and how they could take part. During this stage, people also **read** the different questions and answer options displayed on the VoxBox. Unlike the Visualising Mill Road and Fair Numbers studies, engagement with the visualisations was generally low – and the time people spent on reading the visualisations was often short. Similarly, people were rarely observed actively comparing the data shown on the different displays with their own views, or with the data from other questions. Furthermore, during the understanding stage, people rarely questioned the researchers, or other people around them, about the installation.



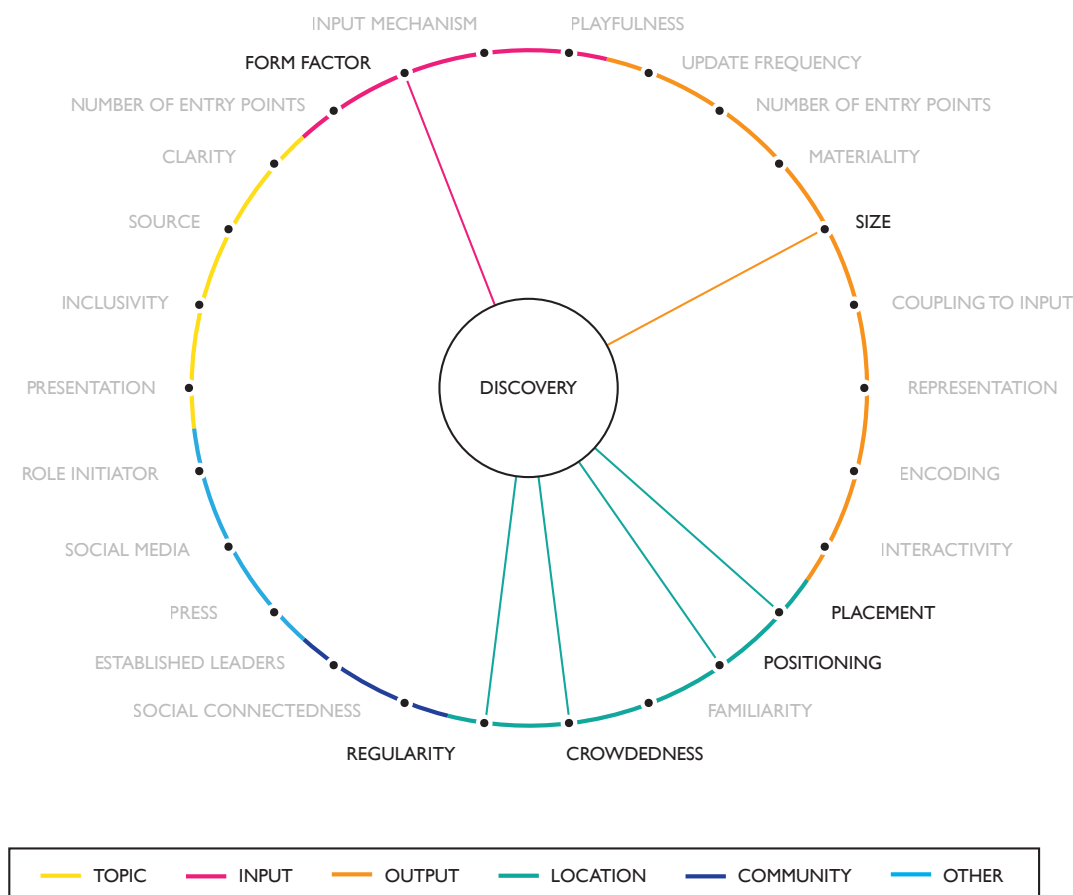
**Figure 6.10:** Types of engagement with the input technology and output visualisations

In the interaction stage, people **submitted** their perceptions of the event using the various input mechanisms. During the VoxBox deployments, a new type of engagement emerged: many people **collaborated** while interacting with the installation. Many of the interactions took place in groups, often consisting of families with children. These groups frequently collaboratively answered the questions and assigned roles either verbally or non-verbally, to establish who would do what during the interaction. One person generally took the lead and guided the people in their company through the survey by reciting the questions and answer options.

In the sharing stage, people **discussed** the data shown on the displays at the back of the VoxBox. These conversations typically took place between people who attended the event together. During the conversations people were observed pointing at the visualisations, to encourage those around them to look at specific data. Overall, discussions were brief and contained little sense-making of the data. A number of factors likely contributed to this lack of engagement with the visualisations, such as: the size of the screens, the limited visibility of the screens in bright sunlight due to glare, and the pace at which the visualisations refreshed – which are further discussed in Section 6.5.2. The VoxBox also did not evoke championing behaviour, or publishing.

## 6.5.2 Design and contextual factors

### 6.5.2.1 Discovery and rediscovery



**Figure 6.11:** Factors framework: factors relating to discovery

#### Form factor of input

The use of a range of colourful and varied input methods gave the VoxBox a unique and play-

ful appearance, evoking curiosity in many passers-by – who as a result often approached the device. People's fascination with the appearance of the device regularly resulted in queues at the input side of the VoxBox. The form factor played a key role in facilitating discovery.

### **Size of output**

The small size of the visualisations meant that people had to approach the displays in order to read what was displayed. This limited discoverability, and combined with the positioning of the visualisation (see Positioning) this meant many people did not organically find out about the existence of the visualisations.

### **Placement**

The placement of the VoxBox in central locations, along the main walkways of the events, ensured that a continuous stream of people passed by – increasing the chances of someone noticing the installation.

### **Positioning**

The positioning of the VoxBox in relation to the walkways proved key in facilitating discovery, in particular discovery of the visualisations. The orientation of the device in relation to the main walkway proved key in attracting people to the visualisation side. During the first event, when the VoxBox was positioned parallel to the walkway, with the input side facing the walkway, active shepherding from the researchers was required to ensure people were aware of the visualisations. When, at the second event, the VoxBox was positioned perpendicular to the main walkway, shepherding was no longer needed as people discovered the rear organically when walking past.

### **Crowdedness**

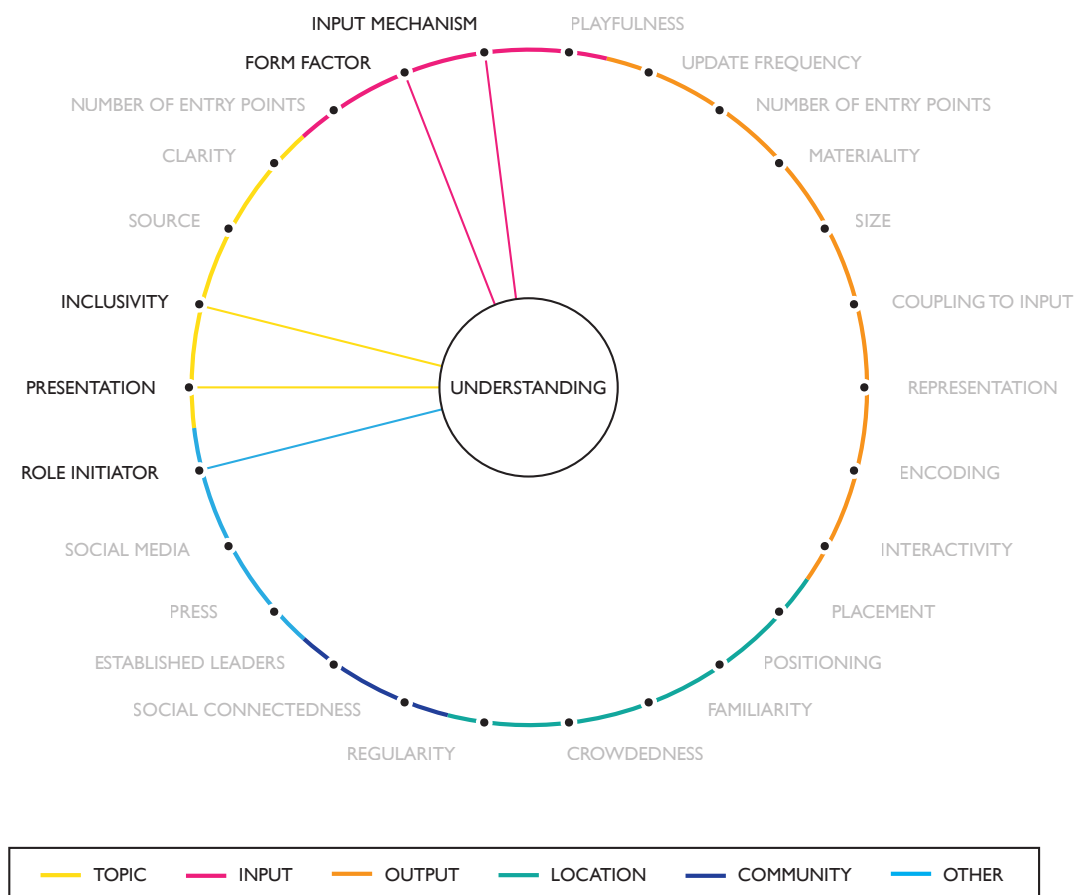
The crowdedness of the event was found to affect discoverability both positively and negatively. On the one hand, the presence of others near the VoxBox was found to attract others to the device, and the honeypot effect was observed regularly. On the other hand, this crowdedness also limited the visibility of the device, because of which others passed by the device without being able to notice it.

### **Regularity of location**

As the events hosted a number of activities, the VoxBox was only one of many irregular elements designed to engage people. As a result, the VoxBox was competing with many other stalls for the attention of passers-by. The presence of other eye-catching, colourful,

and attractive activities made the VoxBox stand out less – and decreased the chances of people noticing the installation. This aligns with the findings from the Fair Numbers study (Chapter 5), in which this was also observed.

### 6.5.2.2 Understanding



**Figure 6.12:** Factors framework: factors relating to understanding

#### Presentation of topics

As all questions were presented on the vertical surface at the front side of the installation, people were able to view and study the device in order to learn more about what topics it would ask them about, and how they could engage with it. In other words, the presentation of all questions at the same time enabled people to grasp what the installation was about before interacting with it.

#### Inclusivity of topics

The questions posed by the installation were purposely phrased in a way that was meant to make them accessible and understandable to people from a wide range of ages and back-

grounds. This approach was found to successfully create understanding, as only very young children needed support from their parents in order to comprehend the questions.

### **Form factor of input**

The large size of the VoxBox, and the placement of the input methods on vertical panels, enabled onlookers to observe how others interacted with the device by looking over their shoulder, allowing them to find out how to use the installation before participating themselves. This learning by observing others was observed regularly during both events.

### **Input mechanism**

The choice of simple input mechanisms, which people were likely to be familiar with, ensured that people understood how to interact with the device simply by looking at it.

### **Role initiator**

Originally, the presence of multiple researchers near the VoxBox was only meant to aid the evaluation of the installation, as the researchers conducted observations. However, when it became apparent that people rarely engaged with the output, the researchers took up a more active role, explaining that the VoxBox had both an input and output side. This involvement created understanding of installation's functionality and encouraged people to view the visualisations too.

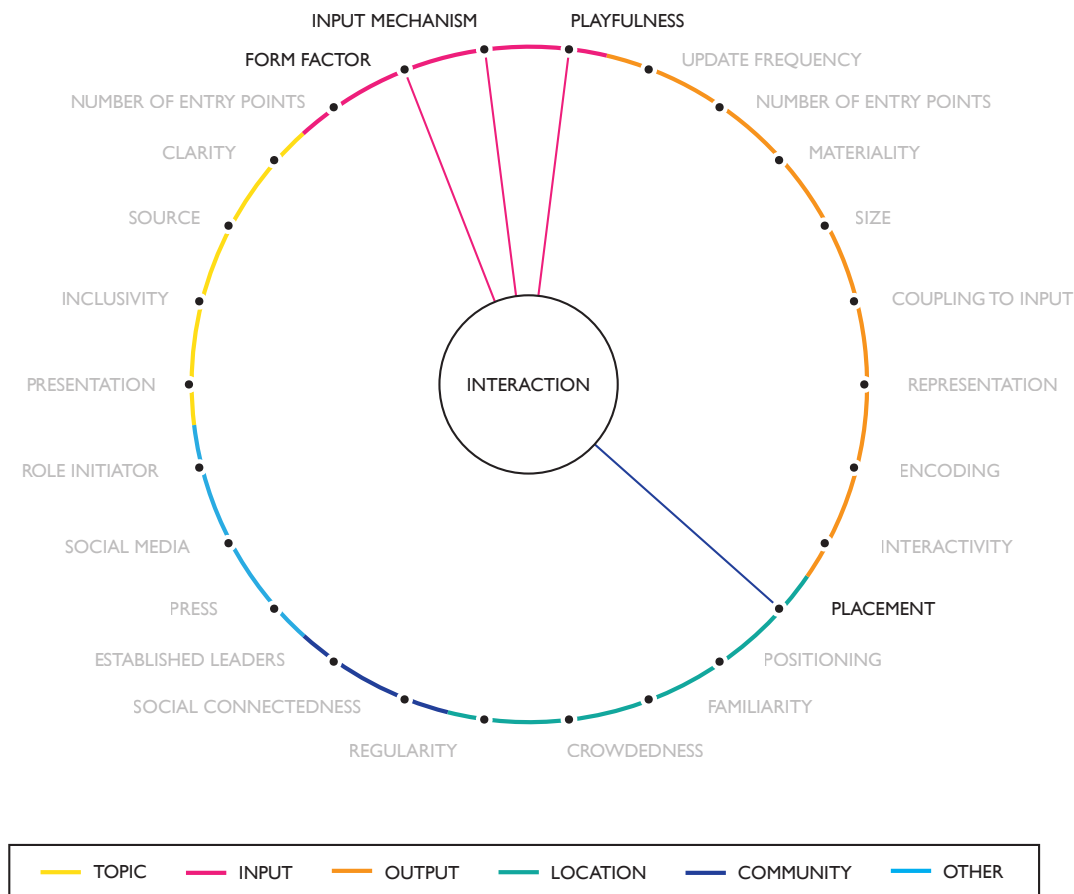
## **6.5.2.3 Interaction**

### **Form factor**

The large size of the VoxBox also facilitated collaborations, as multiple people were able to stand in front of the device simultaneously. In addition, the layout of the input mechanisms enabled people to collaboratively interact with the device.

### **Input mechanism**

The different input methods provided familiarity while also evoking excitement. Answering the questions was largely done using simple, intuitive interactions, such as pressing buttons and moving sliders. Because of this, people from different ages and backgrounds were able to participate without requiring support. At the same time, the input technology and corresponding LEDs provided an experience in which people were able to interact with numerous input mechanisms, that are typically only seen in science fiction movies or on dashboards of complex vehicles.



**Figure 6.13:** Factors framework: factors relating to interaction

### Playfulness

The tangible and colourful aesthetic of the device gave the VoxBox a playful character, which enticed people to interact with the installation – as they expected the interaction to be a fun experience. Kids, in particular, were found to be attracted to the playful look of the VoxBox.

### Placement

The placement of the installation along walkways facilitated easy access to the installation, which allowed people to interact and then continue their journey through the event. In other words, because people did not have to go out of their way to take part, the placement encouraged interaction.

#### 6.5.2.4 Sharing

#### Size of output

While the visualisations were small, their positioning at the back of the VoxBox enabled





**Figure 6.14:** Factors framework: factors relating to sharing

multiple people to convene around them and discuss them. Although this sharing was found to be limited, the set-up did enable people to point at screens to share the displayed data.

### Crowdedness

The presence of multiple people around the device encouraged sharing, and conversations were regularly observed. However, the majority of this sharing behaviour was found to take place between people who already knew one another and attended the event together.

## 6.6 Summary

This chapter described the design, deployment, and evaluation of the VoxBox, an installation aimed at collecting feedback at events – and visualising this data back to the attendees of the event. The findings from two one-day in-the-wild studies revealed that the input technology successfully attracted an almost continuous stream of participants, with people queueing in order to take part. Furthermore, the findings showed the vast majority of people answered all questions posed by the device before leaving, thereby engaging with the VoxBox for

at least several minutes. However, engagement with the visualisations at the rear of the installation was low and usually short-lived. The findings show that several design elements of the VoxBox likely affected this engagement, including the positioning of the device – with people not noticing the presence of the visualisations at the rear of the device – and the small size of the displays, which further limited discoverability.

The next chapter sets out how the VoxBox was reappropriated for a different type of event, with the aim of overcoming several of the design shortcomings that emerged from the first two VoxBox deployments.

## Chapter 7

# Case Study IV: VoxBox Reappropriated

### 7.1 Introduction

The first two VoxBox deployments revealed that several design elements of the VoxBox hindered engagement with the installation. The visualisations proved particularly problematic, as active shepherding by the researchers was required to ensure people were aware of their existence of the back of the VoxBox. Furthermore, engagement with the displayed content was minimal. Therefore, it was decided that a redesign of several aspects of the VoxBox would be worthwhile, to investigate if some of these issues could be overcome. The redesign was informed by the findings from the previous deployments, and its main aim was to foster greater interest in the back of the installation.

After the initial deployments, an opportunity emerged for an additional in-the-wild study of the VoxBox: a 2-day deployment at a science fair aimed at children and their parents. This fair was organised by University College London, with the aim of getting young people interested in science. The UCL Centre for Engineering Education department, who had heard of the previous VoxBox deployments, expressed interest in deploying a customised version of the VoxBox at the fair. They were primarily interested in encouraging children to think about the wide range of science-related jobs.

This study was conducted in collaboration with Dr Sarah Gallacher and Dr Connie Golsteijn. More information about this collaboration can be found in Section 3.5.

### 7.1.1 Setting

The study was held at the first edition of Spark Festival, an annual science fair organised by University College London. The two-day festival mostly targeted families with children, with the aim to make attendees more familiar with science in general, and specifically with the research conducted at UCL. The festival was held on a publicly accessible field in the Queen Elizabeth Olympic Park in London. On this field, different demonstrations were given in open tents lined up at the edges of the field by students and staff from the university. Several food trucks and a live band were located in the centre of the field.

### 7.1.2 Research objective

The specific research focus of the VoxBox Reappropriated study was on the use of more personal topics, central input technology with a variety of input methods, and central, interactive visualisations (as shown in Figure 7.1). This focus is further detailed below.

CASE STUDY	TOPIC	INPUT	OUTPUT
I: VISUALISING MILL ROAD	COMMUNITY-GENERATED	VOTING (D)	DELAYED UPDATES (D)
II: FAIR NUMBERS	ENVIRONMENTAL	VOTING (D)	REGULAR UPDATES (C)
III: VOXBOX	EVENT FEEDBACK	MIXED (C)	REAL-TIME UPDATES (C)
IV: VOXBOX REAPPROPRIATED	PERSONAL	MIXED (C)	TAKEAWAY (C)
V: SCRIBBLES, MAGNETS, TYPEWRITER	OPEN-ENDED	TEXTUAL (D)	INTERACTIVE (C)
VI: URBAN TYPEWRITER	CONSULTATION	TEXTUAL (N)	DELAYED UPDATES (N)

**Figure 7.1:** Research focus of the VoxBox Reappropriated case study (D = distributed, C = central, N = nomadic)

The first VoxBox deployments revealed that people, primarily adults, were able to understand and answer the posed questions with ease. For the Reappropriated study a large proportion of event attendees was predicted to be children. Therefore, the addressed topics had to be more inclusive. The use of more personal questions, asking people about their personality and interests, was investigated:

**VBR RQ1: How does the use of personal topics affect engagement?**

In addition to being more inclusive, the use of these personal topics was also intended to evoke more interest in the visualisations at the back – where people could again view the answers provided by others.

Furthermore, to motivate people to explore both sides of the VoxBox, an additional element was added to the installation: a printer that presented participants with a personalised takeaway after they submitted their final answer:

**VBR RQ2: How does the use of a personalised takeaway affect engagement?**

This addition was primarily intended to lure people to the back in a naturalistic manner, without requiring active shepherding by researchers.

## 7.2 Redesign

As there was limited time available for the redesign, only a handful of changes were made, keeping the VoxBox largely identical to the first deployments. The redesign was primarily focused on two elements of the installation: the topics and the visualisations. Observations and video analysis at the first two VoxBox deployments revealed that people showed little interest in viewing or discussing the aggregate data shown on the displays at the back. To motivate stronger discourse, the choice was made to focus on more personal data. Instead of asking questions about the overall experience of the event, the VoxBox was redesigned to ask people questions around the general theme of “*What kind of engineer are you?*”. By focusing on this topic, it was hoped that people would expect the installation to provide them with an outcome once they had answered all questions. By printing people’s results at the back of the VoxBox, a more organic flow of moving around the VoxBox was created — with the intention of luring people to the back of the device.

Although the new version of the VoxBox still contained 15 questions, almost all questions were replaced. Answers options for the demographics information was amended to fit the event, for example by offering more detailed age options for younger people – the demographic expected at the festival. The themes were altered to address the theme of engineering. After the collection of demographics information, the VoxBox addressed an individual’s characteristics (e.g. is someone more keen on history or science), followed by their preferred activities (e.g. is someone more keen on thinking or doing), and preferred workplace (e.g. in

what kind of environment would they like to work). A complete overview of the new set of questions can be found in Table 7.1. In addition, colourful icons relating to each answer were displayed on the physical spinners, to make the installation more accessible to children.

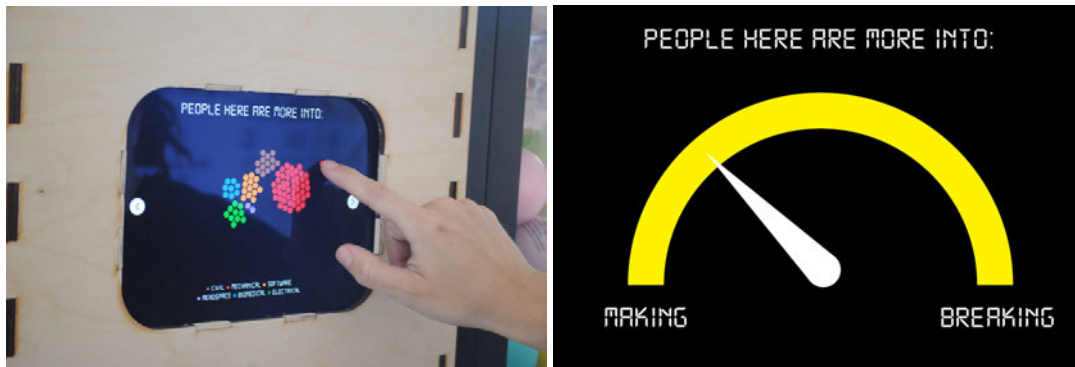
Demographics			
1	What is your age?	0-14; 15-18; 19-25; 26-45; 46-65; 65+	Rotary knob
2	Where do you live?	Nearby; somewhere else in London; somewhere else in UK; abroad	Button
3	With whom are you visiting this event?	Alone; partner or family; friends; other	Button
4	Are you?	Female, male, other	Button
Characteristics			
5	Are you more into maths or arts?	Continuous scale (maths - arts)	Rotary knob
6	Are you more into history or science?	Continuous scale (history - science)	Rotary knob
7	Are you more into sports or music?	Continuous scale (sports - music)	Rotary knob
Preferred activities			
8	Making things - breaking things	Continuous scale	Slider
9	Thinking — doing	Continuous scale	Slider
10	Fixing things — taking things apart	Continuous scale	Slider
11	Helping others — working by yourself	Continuous scale	Slider
12	Experimenting — following procedures	Continuous scale	Slider
Workplace			
13	In which of the following places would you like to work most?	At a desk; in nature; in outer space; in a laboratory; in a workshop	Physical spinner
14	Which of the following tools would you like to use most while working?	A computer; a telescope; hammer and wrench; a beaker; a soldering iron	Physical spinner
15	a) Can you name a famous engineer? b) Can you name a famous piece of engineering? c) How many types of engineers do you think there are?	Open question	Phone

**Table 7.1:** VoxBox redesign: questions, answer options, and input methods

Upon completion of the frontside of the VoxBox, people could retrieve their ‘results’ at the back of the installation. Here a printer mounted onto a laser cut panel printed a receipt with the type of engineer the participant was – as determined based on their answers. A simple mapping of answer options and types of engineers was created to quickly deduce the result (e.g. a preference for working in outer space generally led to the aerospace engineer suggestion). Due to the informal nature of the questions and answer options, the outcome was not meant to be perceived as an official career recommendation. Instead, the text on the receipt said: *“Based on the answers you have given, the VoxBox has calculated your result... have you thought about becoming a mechanical engineer?”* A total of six kinds of engineers were included, determined in consultation with UCL’s department of education: aerospace engineer, biomedical engineer, civil engineer, electrical engineer, mechanical engineer, and software engineer. Each receipt also included an icon corresponding to the recommendation. For example: an icon of a computer was printed onto the receipts suggesting people to consider becoming a software engineer.

In addition, the visualisations on the displays at the back were changed. Whereas the visualisations used during event 1 and event 2 updated automatically, by scrolling through different screens, for this final deployment a set of interactive visualisations was created. The findings from the first studies showed that many people stayed at the rear for a short period of time, and that they did not wait for the visualisations to update and scroll through all data. By using an interactive set-up, it was hoped that people would not have to passively wait, but that they could instead browse through the results at their own pace. To ensure the displays were easy to reach, the peephole walls around the screens were removed. As the VoxBox was placed underneath a gazebo that was closed off on three sides, sunlight could not affect visibility of the displays.

Furthermore, the visual representations of the data were adjusted to fit the collected data. The new visualisations consisted of a series of various animated gauges and a bubble chart (see Figure 7.2). All representations were displayed in bright colours on a black background, to maximise the contrast and ensure the visualisations were highly visible. Arrows on the left and right of the screen enabled people to scroll through the various visualisations.



**Figure 7.2:** Left: VoxBox visualisations without peephole. Right: detail of updating process; the dots are flipped row by row.

### 7.3 In-the-wild study design

The key objective of the final VoxBox deployment was to evaluate engagement with the back of the device, to establish whether the changes to the topics and visualisations affected people's level of engagement with the data. The set-up was kept almost identical to those at event 1 and event 2. Nevertheless, the positioning of the device was influenced by the organisation of the festival, who provided gazebos to people at all pitches. These gazebos were closed off by plastic walls at three sides, providing only one entrance and exit. Due to space limitations the VoxBox was placed parallel to the main walkway, with the frontside facing people and the rear facing the back of the gazebo.

For the purpose of video analysis, one camera was placed at the front to film interactions with the input side, and one camera was placed at the back to film interactions with the receipt printer and visualisations.

Three researchers were present near the VoxBox at all times, to assist people and answer questions.

### 7.4 Findings

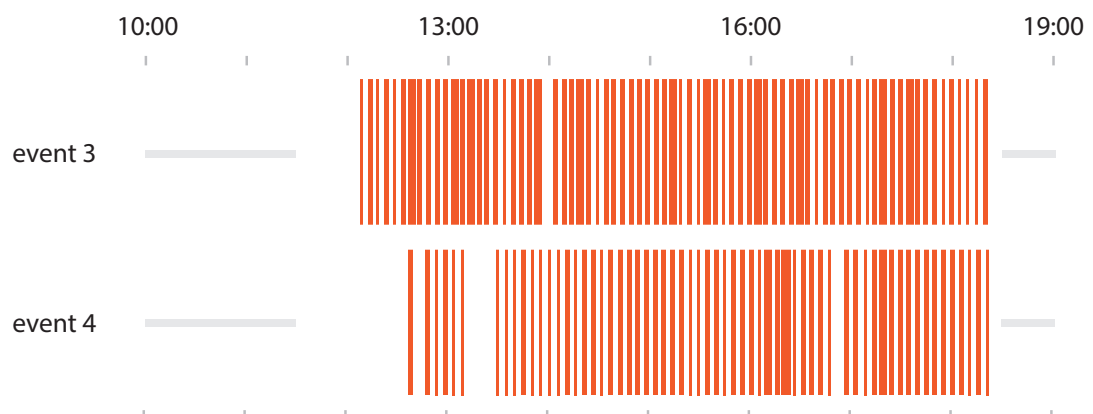
The VoxBox was deployed at the festival for two days (henceforth referred to as event 3 and event 4). During both days, the installation was open to the public for 6 hours. Due to bad weather and flooding at the festival site on the second day, the festival had a relatively slow start. However, on both days the VoxBox was occupied almost continuously throughout the day, by children as well as adults. Due to the popularity of the installation, queues regularly formed at the front of the VoxBox pitch (see Figure 7.3).





**Figure 7.3:** A queue forming at the front of the VoxBox

A total of 252 entries were submitted to the VoxBox, 145 during event 3, and 107 during event 4. An overview of the entry submission times can be found in Figure 7.4, showing that the VoxBox was in almost constant use. Most of the interactions involved groups, in particular families with children. Many of the types of engagement observed during event 1 and 2 were observed again, such as the input side evoking curiosity, people queueing, and groups of people participating collaboratively.



**Figure 7.4:** Submission times of entries to the VoxBox, showing almost continuous occupation of the device during event 3 and 4

The focus of the final deployment, however, was on the interactions with the output side of the VoxBox. The following sections describe these in detail.

### 7.4.1 Receipts

By printing the results on a receipt at the back of the VoxBox, for people to take home, it was hoped that people would be encouraged to walk towards the back. This approach proved highly successful: during the two-day event, the receipts from all 252 interaction sessions were retrieved by the person or people who had submitted their data. The observations revealed that after answering all questions on the VoxBox, people naturally expected a ‘result’ of some kind and as a result were drawn to the rear of the device. People who had observed others participating before them were aware of the existence of the receipt printer. Once participants discovered the printer and waited for their receipt to fully come out, some explored the nearby visualisations (see Section 7.4.2), while others closely watched the printer out of curiosity about their results (see Figure 7.5). Several children pulled on the receipt while it was still being printed, thereby interrupting the printing process which occasionally resulted in illegible text. The process of tearing off the receipt once it was printed proved difficult for both children and adults, as it required an upwards motion along the sharp edge of the printer, whereas many people expected it to tear when they pulled it out straight – similar to a ticket machine. Throughout the day, the researchers frequently assisted people in removing their receipt.

The recommendations printed on the receipts were found to act as a trigger for conversation, especially for families. Many children who took part showed their receipt to their parents after collecting it, who often responded by relating the VoxBox recommendation to their family history (e.g. *“Just like your dad!”*, *“That will make your grandpa happy!”*, *“Electrical engineer, yes! Amazing, it must be in the genes”*). Furthermore, many children were unfamiliar with the different kinds of engineers, and asked their parents for clarifications (e.g. *“What does a civil engineer do?”*, *“Biochemical engineer, what is that?”*).

Additionally, people used the receipts to compare their results (e.g. *“I got mechanical too!”*, *“Oh, you got the same one as me!”*, *“Charlie is a mechanical engineer, like me!”*). While some people were satisfied with their recommendations (e.g. *“Yes, I got software engineer!”*, *“Well, you do like buildings things, so now you have something to think about!”*), not everyone was happy with their results (e.g. *“I don’t want this”*). Most people, however, interpreted the text printed



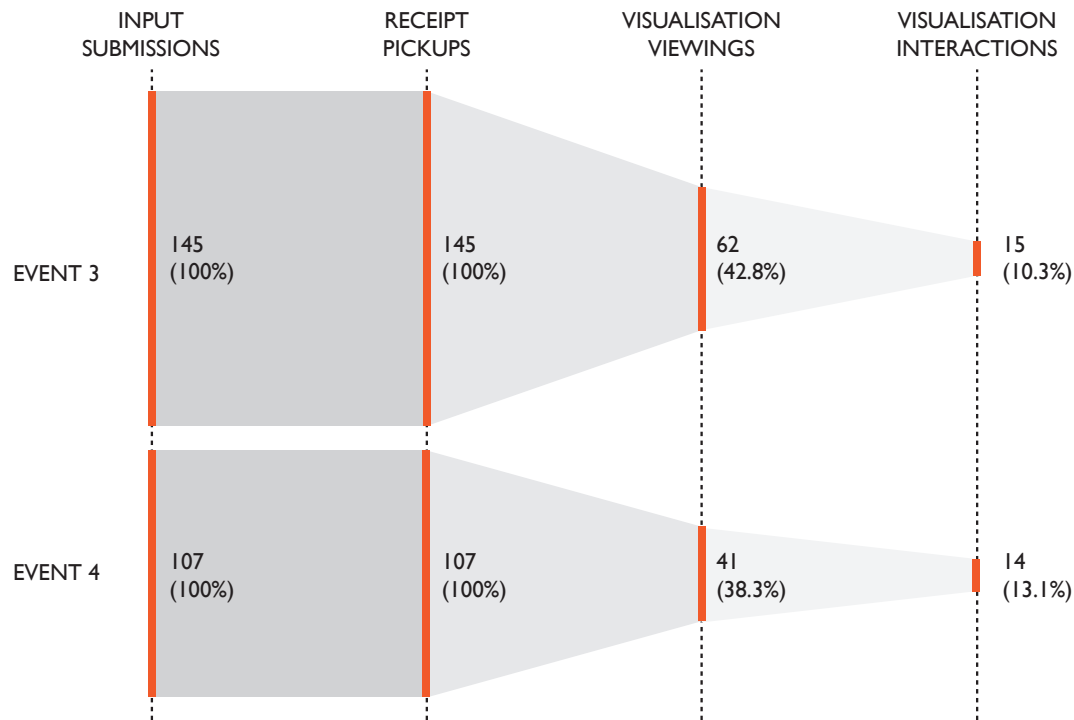
**Figure 7.5:** Boy watches his receipt being printed, while another boy looks on

on the receipt lightheartedly and joked about less suitable recommendations. For example, one boy told his mother, who had received the ‘software engineer’ recommendation: “*you don’t even know how to work the iPad*”), resulting in great hilarity among all family members. Similarly, other parents jokingly exclaimed: “*Oh dear! We are parents of an electrical engineer*” and “*Mechanical engineer? Oh no! Oh well, at least they are not architects*”.

#### 7.4.2 Viewings

The redesign of the VoxBox was primarily concentrated on attracting more people to the visualisations, by using the receipt as a tool to lure people to the back. As shown in Figure 7.6, all receipts were picked up by the people who submitted their data. Despite the fact that this redesign managed to create a more natural flow between the front and the back of the device, which meant shepherding was no longer required, the visualisations were not viewed by all participants. As shown in Figure 7.6, approximately 40% of the individuals or groups who walked towards the back to collect their receipt looked at the visualisations screens. Only approximately 11% of viewings also involved interaction with the displays.

These findings show that engagement with the visualisations after the redesign was comparable with the engagement at event 2 (see Table 7.2).



**Figure 7.6:** Flow chart of VoxBox engagement over time: after submitting everyone picked up their result receipt, but fewer people also looked at the visualisations, and even fewer interacted with the visualisations

Event	Submissions	Visualisation viewings	Viewings as percentage of submissions
Event 1	109	20	18.3%
Event 2	41	16	39.0%
Event 3	145	62	42.8%
Event 4	107	41	38.3%
Total	402	139	34.6%

**Table 7.2:** Submissions and visualisation viewings compared per event

At event 3, 40.3% of the people who viewed the visualisations were female, and 59.7% male. A majority of the viewers was under 18 (59.7%). The demographics of the people viewing the visualisations at event 4 were similar, with 36.6% female compared to 63.4% male viewers, and 59.7% of viewers being under 18. Viewings often took place in groups, with an average group size of 1.9 ( $\sigma = 0.7$ ) at event 3, and 1.5 ( $\sigma = 0.7$ ) at event 4.

On average, people at event 3 looked at the visualisations for 39.6 seconds ( $\sigma = 42.5$ ), and 29.8 seconds ( $\sigma = 33.7$ ) at event 4. In comparison, during event 1 people looked for an average of 36 seconds ( $\sigma = 29$ ), and during event 2 for an average of 20 seconds ( $\sigma = 26$ ). These findings

suggest the redesign of the visualisations had little to no impact on the duration of people's engagement.

For some, viewing the visualisations sparked conversations, while others looked at the data in silence. During event 3, the displayed data was discussed in 36.4% of the viewing sessions. During event 4 this was slightly lower, at 17.9%. While some people merely read out loud the information on the screen (e.g. *"Apparently a 100% of people want to work in outer space"*), others tried to interpret how this data came to be (e.g. *"People here are more into breaking [than making]. To be fair, that is to be expected with the average age here..."*, *"It says 15% want to work in outer space, that's quite a lot! Very particular demographic here"*, *"I mean that has got to be quite... not that accurate, right? But still, it'll get them [points at her children] thinking!"*). Overall, conversations about the visualisations were brief, similar to those at event 1 and 2. The key difference, however, was that many of the conversations made connections between the displayed data and their personal recommendations (e.g. *"55% of people had mechanical engineer... Terry is one of them!"*, *"A 100% want to work in outer space – that would be you, wouldn't it?"*).



**Figure 7.7:** Interactions with the visualisations during the event 3

## 7.5 Discussion

The objective of the VoxBox redesign study was to investigate if removing several of the key design flaws would improve the level of engagement and duration of engagement with the visualisations. The findings show, however, that the changes made to the visualisations had little to no impact on engagement. However, the introduction of a memento of the interaction, in the shape of a receipt, did successfully engage people in several ways.

**VBR RQ1: How does the use of personal topics affect engagement?**

The use of personal topics was aimed at providing an inclusive installation, suitable for people of a wide range ages. In addition, the use of these personal topics was aimed to evoke more interest in the visualisations at the back. The findings from the study showed that this change of topics successfully enabled children to take part independently. However, engagement with the visualisations remained low, with the change of topics having no noticeable effect on this.

#### VBR RQ2: **How does the use of a personalised takeaway affect engagement?**

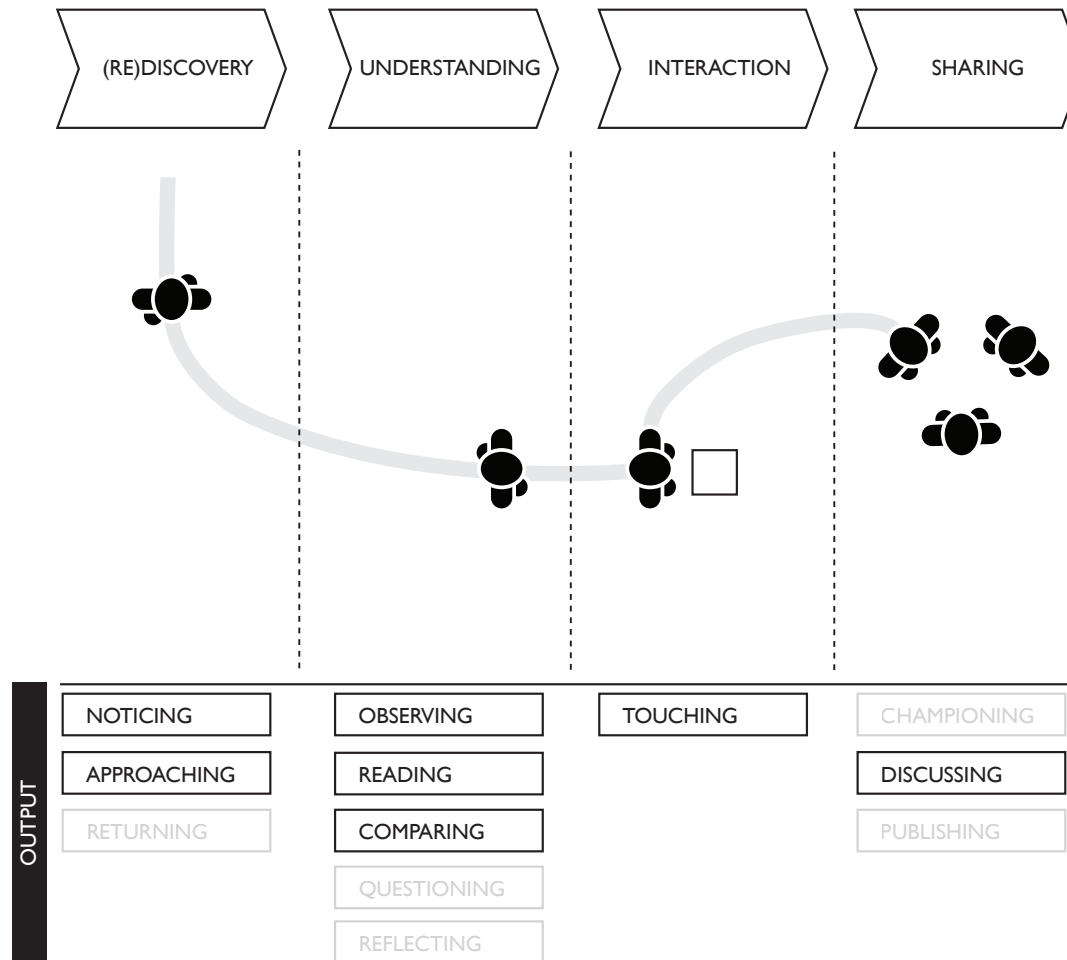
The introduction of a personalised takeaway was intended to motivate people to visit the back of the installation in a naturalistic manner, without the involvement of researchers. Findings from the study showed that this approach successfully encouraged all people who made use of the input side to also visit the back. Observations revealed that people, primarily children, were often highly curious about the advice printed on their receipt.

By creating this flow between the front and rear of the VoxBox, the objective was also to increase engagement with the visualisations. However, while the printer managed to motivate all participants to walk to the back of the installation, both the level engagement and the duration of the engagements with the visualisations remained comparable to the findings from event 1 and 2.

### 7.5.1 Types of engagement

The deployment of the reappropriated VoxBox elicited various types of engagement, as shown in Figure 7.8. As the focus of the study was specifically on the output, engagement with the receipts and visualisations is described below.

In the discovery stage, people **noticed** the receipt printer and / or visualisations. Unlike during the deployments of the first version of the VoxBox, this discovery did not require active involvement of the researcher or other champions. Instead, people typically discovered the output after finishing their engagement with the input. As the interaction with input made it clear that the VoxBox would produce some type of answer or result, people anticipated that there was more to the device than only input. This, in turn, motivated them to explore and look at the back of the VoxBox – leading to the discovery of the output. Upon noticing the receipt printer, people **approached** to see the message it was printing. Fewer people



**Figure 7.8:** Types of engagement with the receipts and output visualisations

also approached the visualisations. Like the Fair Numbers and VoxBox studies, people did not frequently return to the installation.

In the understanding stage, people **observed** how others interacted with the printer. Watching others receive a printout from the VoxBox frequently encouraged people, children in particular, to interact with the installation. In the understanding stage people also **read** the information displayed via the visualisations. However, engagement with the visualisations remained low, with few people reading, or reading only for a short amount of time – similar to the Fair Numbers and VoxBox findings. Unlike these studies, however, the receipts did evoke **comparison** engagement, with people comparing the advice printed on their receipt with others' receipts or the occupations of their family members.

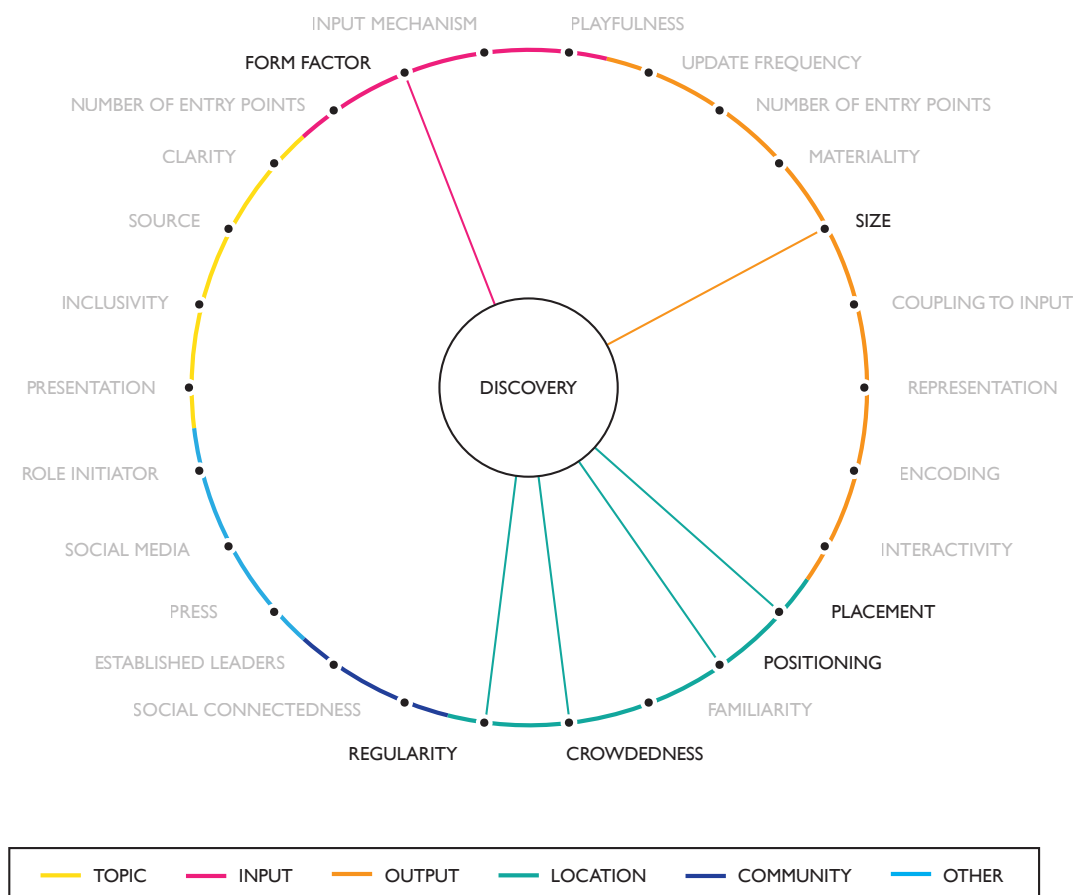


In the interaction stage people **touched** the interactive visualisations to navigate through the representations. However, this engagement was not common, as only some of the people who discovered the visualisations also interacted.

In the sharing stage, people **discussed** the data shown via the displays, and the advice printed on the receipts. The latter, in particular, continuously sparked conversations. Conversations, again, primarily took place between people attending the event together. The VoxBox did not evoke championing behaviour, or publishing.

## 7.5.2 Design and contextual factors

### 7.5.2.1 Discovery and rediscovery



**Figure 7.9:** Factors framework: factors relating to discovery

#### Size of output

The small size of the visualisation screens again prevented people from easily discovering the output. As this was expected, emphasis was placed on the coupling between input and output.



**Coupling to input**

As the findings from the initial VoxBox deployments demonstrated that few people organically discovered the output technology, a clearer and more direct coupling was developed using the receipt printer. By communicating that the VoxBox would provide people with advice (i.e. what kind of engineer you are), people anticipated the presence of output technology: the interaction with the device was not complete without the VoxBox providing them with some kind of outcome. This anticipation encouraged all people to further explore the device, leading them to the output side.

**Positioning of output**

Similar to the findings from the original VoxBox deployments, the orientation of the device parallel to the main walkway limited the discoverability of the output – which was positioned at the back of the installation. As a result, no one discovered the receipt printer or visualisation by walking past. However, as the earlier findings had also demonstrated this, a clearer coupling between input and output was instead created to facilitate discovery.

**Crowdedness**

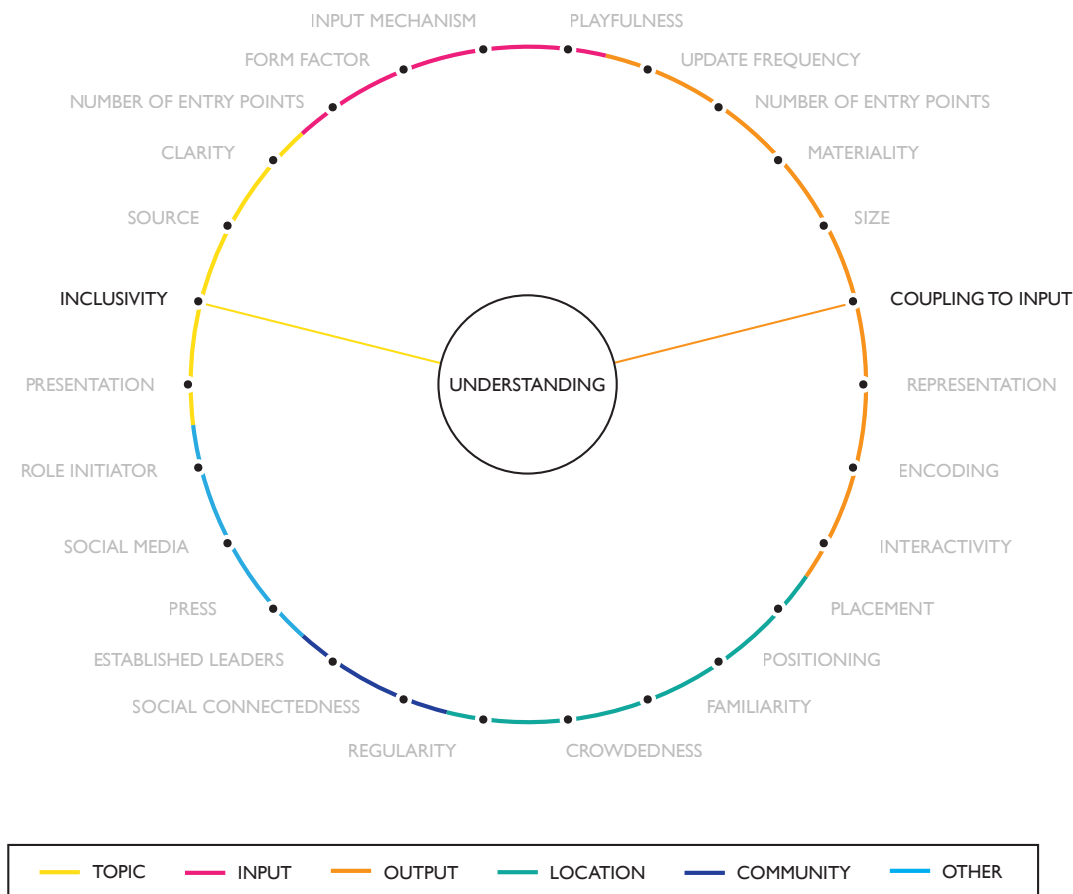
The presence of people around the output was found to attract others to the rear of the VoxBox – increasing discoverability. Unlike the initial deployments, however, the crowdedness was not found to hinder discoverability. Instead, people often joined the queue when noticing other waiting – even without having first seen the VoxBox installation.

**Regularity of location**

The event hosted a variety of activities and events. Because of this, the installation had to, again, compete for the attention of passers-by. However, despite this high level of eventfulness, the VoxBox was used continuously throughout the day, and no active shepherding was required to encourage discovery.

**7.5.2.2 Understanding****Inclusivity**

The use of simple and accessible visuals and textual descriptions enabled people from different ages and backgrounds to understand the receipts and visualisations. While the names of scientific fields were more difficult to understand for younger participants, the use of icons was found to enable them to grasp the direction of advice.



**Figure 7.10:** Factors framework: factors relating to understanding

### Coupling to input

The link between input and output was made more clear by presenting the VoxBox as an installation that would provide people with advice. This framing made people understand both the purpose of the device and what they could expect from it. Unlike during the initial VoxBox deployments, this coupling ensured that no involvement of the researchers was required, as people were able to independently grasp how to interact.

#### 7.5.2.3 Interaction

##### Materiality of output

The use of a receipt printer, with which people are highly familiar due to their ubiquitous presence in shops, helped convey that they could collect a physical takeaway. When, during the printing process, the receipt emerged from the VoxBox, people were observed touching the printout and holding it until it was fully printed.



**Figure 7.11:** Factors framework: factors relating to interaction

### Interactivity of output

The use of digital displays with obvious interactive elements, such as buttons with arrows, communicated that people could interact with the visualisations. However, only a proportion of people who viewed the screens also touched them, showing that – for most people – these elements by themselves did not evoke interaction behaviours.

#### 7.5.2.4 Sharing

##### Size of output

While the small size of the visualisations was not found to support discovery, it did enable multiple people to convene around the rear of the VoxBox. Again, people were observed pointing out visualisations to those around them, and discussing the displayed data – in particular how the data compared to the advice they had received from the installation.

##### Materiality of output

The overall experience of receiving a tangible result proved highly successful. Not only did



**Figure 7.12:** Factors framework: factors relating to sharing

all participants collect and keep their receipt, the recommendations provided on the receipts also regularly sparked conversations about engineering, interests, and family history. The ability to show the receipt to others proved key in this, highlighting how physical takeaways can foster sharing behaviours.

### Crowdedness

The presence of multiple people around the VoxBox at all times enabled people to easily engage in sharing behaviour, like commenting on the receipts and visualisations and discussing careers in science. While the vast majority of sharing behaviour took place between people who attended the event together, people were also observed talking to, and comparing their receipts with, strangers.

In conclusion, although the new set-up removed the issues around the glare of the screens, and the restricted visibility caused by the combination of the low screen height and the port-holes, these improvements did not change the duration of engagements. Furthermore, the

introduction of interactive visualisations that enabled people to navigate through various visualisations were only explored by a small percentage of people, usually for a short period of time and without provoking discourse. In comparison, more conversations were evoked by the receipts, that appeared to engage people more in thinking about a range of different aspects of their lives, such as their schooling, their interests, and their family. These conversations, however, were focused on their personal backgrounds and perceptions, not those of other attendees.

The lack of interest in the visualisations can likely be partly explained by the high number of children participating at all four events. However, the adults who viewed the visualisations also stayed for a short length of time, independent of the data and type of visualisations shown. These findings indicate that people may not have expected the presence of visualisations, and therefore may not have known what to do with, or expect from the displays. Clearer communication of the functionality and aim of the visualisations may help overcome this by allowing people to understand more easily how they can engage. Alternatively, there may be a larger issue at play: the level of interest in data about other people's perceptions in the context of an event. The events that were studied all attracted between hundreds and thousands of attendees from different areas within and outside of London. As a result, there were no pre-existing relationships between people, and the likelihood of coming across the same people again in the future were minimal. Which raises the question: to what extent are people interested in the opinions of others when they do not know them and are relatively unlikely to ever meet them again? This suggests there may be a distinct difference between event-based communities and residential communities, where people may be more invested in local perceptions due to the fact that they permanently share a geographical space and are more likely to be affected by the local sentiment. This highlights a need for future work that further investigates how engagement with input technology and public visualisations may differ in different settings.

## 7.6 Summary

This chapter described the reappropriation of the VoxBox for a science-themed event. Using the findings from the initial VoxBox deployments, described in Chapter 6, the redesign aimed to combat some of the identified design shortcomings such as the positioning of the installation and the static visualisations which were mistaken for interactive visualisations.

In addition to the introduction of interactive visualisations, and an adjusted positioning of the VoxBox, a clearer link between input and output was created through the framing of the installation as a quiz-like device which would produce a personalised answer at the end of the interaction. The aim of this framing was that it would encourage people to explore where they could retrieve their answer. The findings show that these improvements successfully encouraged people to explore the rear of the installation, but that engagement with the visualisations remained low and short. While all participants retrieved their answers at the rear of the VoxBox, only approximately 40% viewed the visualisations, and only 11% interacted with the visualisations. This raises more general questions about people's interest in locally held perceptions in different contexts – such as neighbourhood settings versus event settings. To what extent is data from people with whom a participant has no shared history, no perspective of a shared future, and only a temporarily shared context (i.e. the event) of interest to passers-by?

The next chapter builds on the findings from the VoxBox study and further investigates the use of three types of input mechanisms. It outlines the design and deployment of three devices in a work setting.

## Chapter 8

# Case Study V: Scribbles, Magnets, Typewriter

### 8.1 Introduction

While the previous case studies explored a variety of input methods, they were largely focused on participation through voting. Although votes can reveal overall sentiment towards topics, they provide little insight into the reasons behind that sentiment. In other words, while votes show *what* people think, they do not capture *why* people think so. Furthermore, because voting restricts people to selecting one option from a list of pre-defined answers, this input method is also highly limited in what it can elicit about people's needs and wishes, as they are unable to truly provide input. For this reason, the collection of qualitative data, that enables people to freely express themselves, is key to getting an in-depth understanding of people's opinions. Such qualitative feedback can be particularly valuable when an organisation, such as a community group, local council, or shop, is looking to answer one or more open-ended questions, for example, as part of a community consultation or in order to gather customer feedback. In these scenarios, questionnaires are typically used to collect data, either online, on paper, or in situated interviews.

While online and paper questionnaires are relatively low cost approaches, they do not guarantee participation of a diversity of people. A more situated approach is often used to complement this data, such as interviews or workshops. These approaches, however, are far more costly, as they require one or more people to recruit participants, conduct interviews, or host workshops. Alternatively, situated technology could be used to collect qualitative data instead. Such an approach raises a number of questions: would such a situated device engage many people? And would the contributions be of a sufficient quality to be of use?

This chapter presents a study investigating differences in participation and the types of contributions between three distinct qualitative input technologies. All three installations also directly displayed the submitted content publicly. Engagement with the devices was evaluated in a university setting, with a view to decide what kind of textual input technology would be most suitable for deployment in a residential community. The findings from this study were then used to inform the study described in Chapter 9.

The Scribbles, Magnets, Typewriter study was conducted in collaboration with Dr Sarah Gallacher. More information about this collaboration can be found in Section 3.5.

### 8.1.1 Setting

During April 2015, part of the Computer Science department of University College London was moved to a newly renovated building within walking distance of the old office. In the following weeks the people who had led the move, including several operational and academic staff members, were keen to learn more about people's opinions on the moving process, the new building, and any improvements that could be made in the short and long term. The researcher approached the building manager and explained that a custom set of feedback technologies could be designed and built to collect such feedback from people throughout the building. The building manager supported this idea, as she believed the installations could help reach many people – which she hoped would help get a better idea of people's perceptions of the move and building.

### 8.1.2 Research objective

The specific research focus of the Scribbles, Magnets, Typewriter study was on topics related to perceptions of the workplace, distributed textual input technology, and central, interactive visualisations (as shown in Figure 8.1). This focus is further detailed below.

The primary aim of the Scribbles, Magnets, Typewriter study was to investigate the impact of three different qualitative input methods on engagement. More specifically: to examine if and how each input method affected the number of people who interacted with the installation, and if and how the input methods affected the quality of the collected data.

The topic of the intervention was focused on a recent move to a new building, which the people involved in the moving process were keen to receive feedback on. The building manager indicated that the feedback would be particularly valuable as it could help her identify



CASE STUDY	TOPIC	INPUT	OUTPUT
I: VISUALISING MILL ROAD	COMMUNITY-GENERATED	VOTING (D)	DELAYED UPDATES (D)
II: FAIR NUMBERS	ENVIRONMENTAL	VOTING (D)	REGULAR UPDATES (C)
III: VOXBOX	EVENT FEEDBACK	MIXED (C)	REAL-TIME UPDATES (C)
IV: VOXBOX REAPPROPRIATED	PERSONAL	MIXED (C)	TAKEAWAY (C)
V: SCRIBBLES, MAGNETS, TYPEWRITER	OPEN-ENDED	TEXTUAL (D)	INTERACTIVE (C)
VI: URBAN TYPEWRITER	CONSULTATION	TEXTUAL (N)	DELAYED UPDATES (N)

**Figure 8.1:** Research focus of the Scribbles, Magnets, Typewriter case study (D = distributed, C = central, N = nomadic)

issues within the building, and help inform the procedures of future building. To collect this feedback, the use of textual input technology was investigated:

**SMT RQ1: How does the use of textual input technology affect engagement and contribution quality?**

Specifically, three different textual input mechanisms were deployed, intended to provide people with a variety of ways to communicate their opinions and perceptions in a more in-depth manner. All collected messages were displayed immediately, with the aim of engaging people in reading and discussing the perceptions of others:

**SMT RQ2: How does the immediate public display of the collected raw data affect engagement?**

To supplement the immediate textual display of the submissions, the study was used to investigate the use of interactive aggregate visualisations of the collected data:

**SMT RQ3: How does the display of interactive visualisations affect engagement?**

The aim of these visualisations was to encourage people to explore popular themes in the collected data, enabling them to compare their personal perceptions with those held by others in the building.

## 8.2 Design

### 8.2.1 Conceptual design

To conduct a study to compare qualitative feedback methods, a range of input technologies was selected. A review of papers on qualitative input methods within HCI showed that there were three main directions: textual, audio, and video input. Due to the chosen setting, inside an office building, publicly collecting either audio or video was deemed unsuitable, as both the input and the display of such contributions would require sound – which would cause disturbances for the people working in the building. Instead, the choice was made to use textual input, to better fit the relatively quiet nature of the office setting. A comparison of textual input methods showed that the key difference between these methods was the level of constraint they imposed, either on the medium or on the content. For example, publicly collecting and displaying messages in public or semi-public settings is typically done using handwritten notes, whether it concerns advertisements on noticeboards, prayer requests, or feedback forms. Writing by hand does not impose restrictions: people are able to express themselves in any way, using any selection of words, drawings, or other written visual communication. The vast majority of recent studies, however, have made use of technology that enables people to type feedback (e.g. Brignull and Rogers (2003); Fischer et al. (2013); Kriplean et al. (2012)). This medium restricts people somewhat: while they are still free to submit any kind of content, they are limited to what the keyboard enables them to type (i.e. typically only letters and numbers in a set font). A small set of studies investigated the potential of an even more restricted input method, where people can only construct sentences using provided words – inspired by fridge magnets (e.g. Dalsgaard and Halskov (2010); Viña (2010)). This approach is restricted both by medium and content, as people can only submit messages in the shape of magnets, and only content containing one or more of the provided words.

For the study, it was decided to include both an unrestricted and a highly restricted input method, in addition to a method in between these two extremes. The key motivation to include more constrained mediums was that it has been shown that constraints can foster creativity (Stokes, 2005). For this reason, the highly restricted method was included to examine if this approach would elicit more diverse contributions. An additional benefit of

the use of restricted input methods is that it can simplify the analysis of the collected data. For example, the construction of sentences from a set of provided words can be easily detected automatically using computer vision. Handwritten messages, on the other hand, enable completely unrestricted input, which means people may write, draw, or choose convey their feedback in another way – making automatic analysis particularly complicated. However, while posing restrictions on input may have benefits for the analysis and visualisation of the collected data, there may also be drawbacks. For example, the restrictions may decrease participation, or decrease meaningful participation.

Name of installation	Medium	Level of constraint
Urban Scribbles	Writing by hand	Unrestricted
Urban Typewriter	Typing	Restricted by medium
Urban Magnets	Arranging provided words	Restricted by medium and content

**Table 8.1:** Selected input methods

Three levels of constraint were investigated: unrestricted input, input restricted by the medium, and input restricted by the medium as well as the content (see Table 8.1). The unrestricted Urban Scribbles was expected to elicit long, in-depth contributions. However, due to the familiarity of the input method and the effort required to submit a handwritten message, this installation was not expected to evoke a high level of engagement. In contrast, the highly restricted Urban Magnets installation was expected to evoke far more engagement – in particular a higher number of contributions – due to its playful and informal input method (arranging provided words). Similar to the Scribbles installation, the Urban Typewriter intervention was expected to be less engaging, as its input method (typing) was highly familiar.

For the study, simple installations were built and evaluated. In addition, for all three installations, initial ideas on how to further develop them into more robust devices, suitable for deployment in a residential community, were developed.

### 8.2.2 Local topics

Topics for questions were determined in consultation with 3 different staff members (1 operational, 2 academic) who had been actively involved in the design of the new building as well as the moving process. These staff members will also be involved in the design of the future departmental building, which the department is expected to move into in the future.

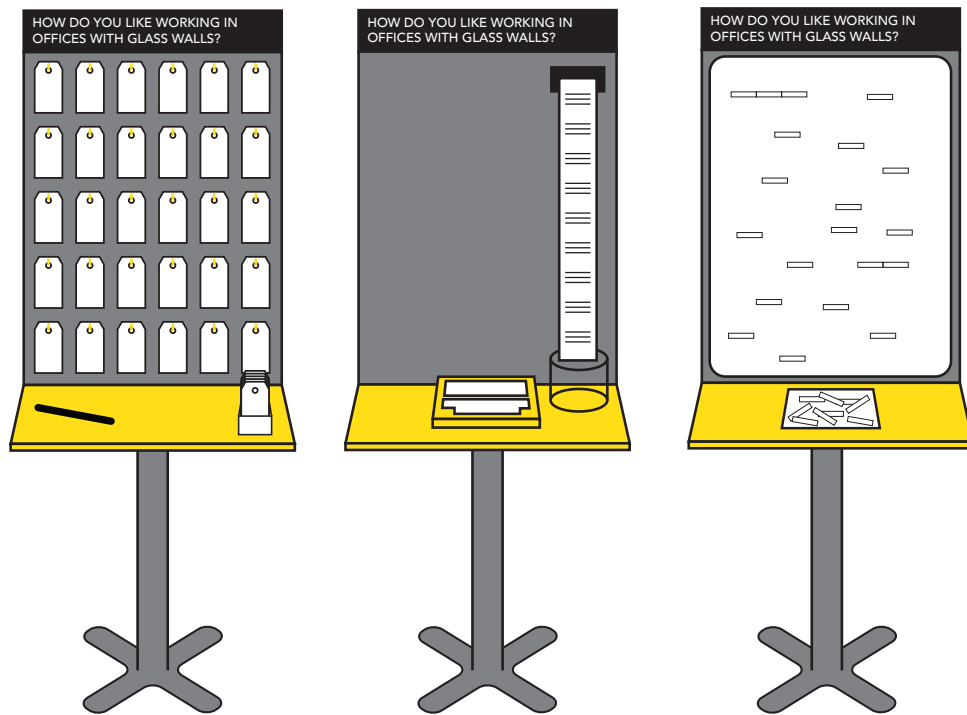
The operational staff member, who acts as the building manager, was particularly keen to receive feedback on the building, as she wanted to address issues and evaluate the success of the both the move and the building design. The topics were collected and tweaked by the researcher, in order to be generic enough to allow all people in the building to respond (i.e. not addressing features of the building that are only present on a selection of floors). For example, one suggested question about the effect of the move on collaborations across buildings was excluded, as only a subset of the people in the building were involved in such collaborations. The final selection of questions addressed different aspects of the building move:

- Q1. What is the best thing about this new building?
- Q2. How could this building be improved?
- Q3. What was the experience of moving building like for you?
- Q4. How does this building affect the quality of your work?
- Q5. Which features should the future CS building have?
- Q6. How does this building affect your mood at work?

The order in which the questions were posed was also determined collaboratively. It was decided to start with two questions about the new building, to allow people to have their say about this new environment, before intertwining questions about the new building with questions about the moving process and the future building. The question addressing the future building was posed late into the deployment to give people time to think about their experiences in the new building, and to read other people's feedback, before making suggestions about what they would like to have in the future.

### 8.2.3 Input technology design

The three installations consisted of an A1-sized medium-density fibreboard (MDF) backboard on top of a 60 cm by 60 cm MDF tabletop, mounted on a metallic leg (see Figure 8.2). To create a consistent look, all three were painted grey, to match the main colour of the building, and yellow, to attract attention to the installations. All questions were printed on foam core and attached to the backboard using velcro, to allow for easy changing of questions.



**Figure 8.2:** Sketches of installations. From left to right: Urban Scribbles, Urban Typewriter, Urban Magnets

### 8.2.3.1 Installation 1: Urban Scribbles

A grid of 40 hooks was screwed into the backboard of the Urban Scribbles installation, to accommodate labels with handwritten messages. At the start of the deployment, empty paper tags were hung on these hooks. Multiple pens and a box containing additional empty labels were placed on the table. If this concept were to be successful, the idea was to further develop the installation to make it appropriate for deployment in a residential community, by using digital pens that automatically detect handwriting.

### 8.2.3.2 Installation 2: Urban Typewriter

A small thermal receipt printer was mounted at the top of the Urban Typewriter installation. This printer was connected to a laptop battery and an Arduino, which in turn was connected to an Android tablet. A custom enclosure was built to hide all technology. A laser cut opening in the enclosure revealed the tablet's keyboard, via which people could enter messages. Upon submission, the thermal printer would add the most recent message to the receipt, ultimately creating a long scroll of messages. A glass jar was placed on the table to catch the receipt once it reached the full length of the backboard. A 'leave your feedback here' message

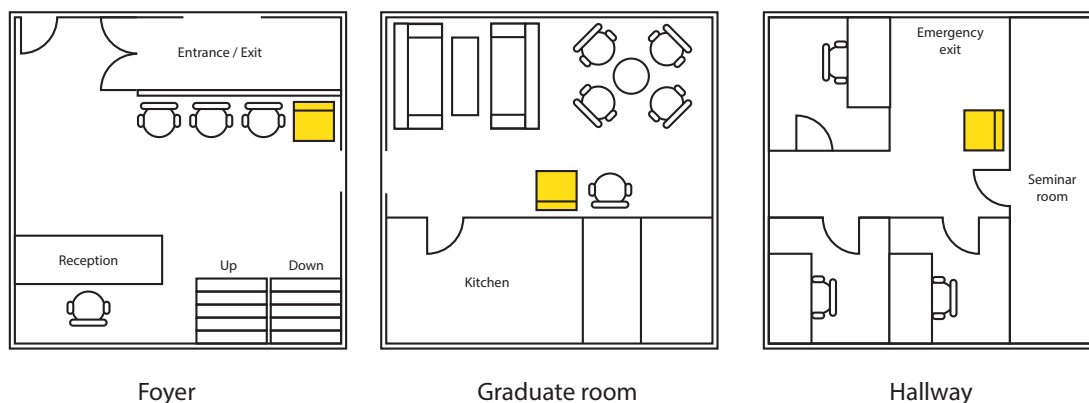
was printed onto the scroll at the start of the deployment. If this concept was successful, the idea was to create a more robust version, suitable for public deployment, using a physical keyboard.

### 8.2.3.3 Installation 3: Urban Magnets

An A1-sized magnetic board was hung from the backboard of the Urban Magnets installation. A container with 630 magnetic words was placed onto the table. The magnetic words were sourced from two different ‘magnetic poetry’ fridge magnet sets: an ‘original’ set and an ‘office-themed’ set. Several words were placed onto the magnetic board at the start of the deployment, to make the purpose of the board clear. If this concept was successful, the idea was to use computer vision to automatically detect new or adjusted messages on the board.

## 8.2.4 Choice of input locations

The three installations were designed to pose questions to people in different locations in the new building. The specific locations were suggested by the building’s manager, who said they were the three most social and popular areas in the building, where people would be most likely to notice the installations and to potentially participate. These locations were: the building’s foyer, graduate room (a space used by students and staff for meetings and lunches), and the hallway adjacent to the main seminar room.



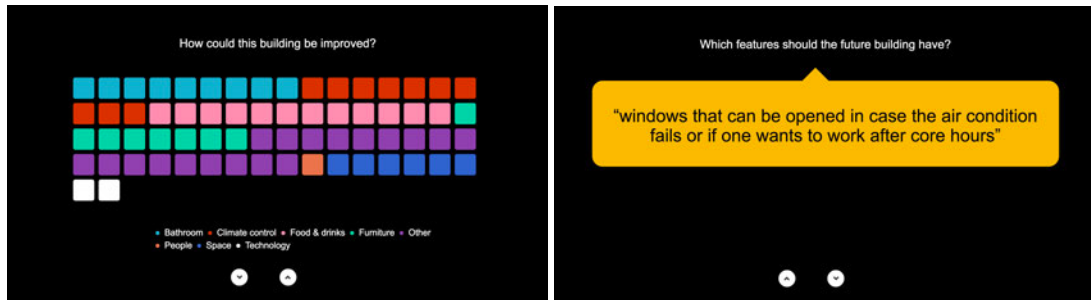
**Figure 8.3:** Overview of 3 different settings in study

Within these locations there were limitations, primarily related to health and safety regulations, that constrained where the installations could be situated. For example, in the foyer, the main walkway to the entrances and exits had to remain free from any obstructions, leaving only one area, in the corner of the foyer, suitable for deployment of an installation.

Within these constraints, locations were selected that people would be most likely to notice while passing by: opposite the building’s staircase, along the main walkway in the graduate room, and next to the entrance of a large seminar room (see Figure 8.3).

### 8.2.5 Visualisation design

The collected messages were displayed and visualised at the end of the deployment, using two tablets mounted on a table in the foyer showing messages by theme, and the raw data.



**Figure 8.4:** Left: visualisation 1, showing messages by theme. Right: visualisation 2, showing raw messages

The first visualisation focused on the display of the themes that the submitted messages addressed (see Figure 8.4). On six pages, the answers to each question were summarised as a series of blocks, coloured by theme (e.g. “bathrooms”, “furniture”, “technology”, etc.). Pressing an individual block displayed the content of that specific message. Pressing the arrows at the bottom of the display allowed people to scroll between the six questions.

The second visualisations focused on the display of the raw data, i.e. the original messages (see Figure 8.4). This enabled people to scroll through all submissions, from all three locations and installations, by pressing the navigation buttons at the bottom of the display.

## 8.3 In-the-wild study design

During the study, two questions were posed per week over a three week period, with both the change of question and rotation of installations taking place on Monday mornings and Wednesday afternoons (see Table 8.2).

After the deployment, semi-structured interviews were conducted with people working in the building. The main objective of these interviews was to get an understanding of how, when and where people engaged with the installations, including: if they noticed the installation(s), if they contributed and why or why not, if they read other people’s contributions,

Period	Question	Foyer	Graduate room	Hallway
Period 1: week 1, Mon – Wed	Q1	Scribbles	Typewriter	Magnets
Period 2: week 1, Wed – Fri	Q2	Typewriter	Magnets	Scribbles
Period 3: week 2, Mon – Wed	Q3	Magnets	Scribbles	Typewriter
Period 4: week 2, Wed – Fri	Q4	Scribbles	Typewriter	Magnets
Period 5: week 3, Mon – Wed	Q5	Typewriter	Magnets	Scribbles
Period 6: week 3, Wed – Fri	Q6	Magnets	Scribbles	Typewriter

**Table 8.2:** Rotation of installations between locations

and if they engaged with the visualisations. A particular focus was placed on people's reasons to engage with the three installations, and barriers to participation, as these findings could be used to inform the design of the deployment in a residential community.

The aim was to interview people from all floors, as the different floors are occupied by people from different research groups. Therefore, a representative from each floor was sought. Furthermore, the aim was to interview people from different backgrounds – including PhD students, academic staff, and operational staff – to get an understanding of the engagement with the installations across occupations. A total of 14 interviews were conducted with people from all 7 floors in the building. These participants (7 female, 7 male) had a range of occupations within the university, from PhD student to operational staff and academic staff. All participants had completed either a Master's degree or a doctoral degree. Participants had 7 different nationalities. Interviews lasted 8 minutes on average ( $\sigma = 3.2$ ) and were conducted in different locations in the building, including in staff members' offices and common rooms. Interviews were conducted over the course of one week.

## 8.4 Findings

During the 3-week deployment, 222 messages were submitted via the three installations. The restricted Magnets installation, and somewhat restricted Typewriter installation received most submissions, while the unrestricted Scribbles installation received far fewer. In addition, the Magnets and Typewriter installation collected most diverse feedback. The interviews revealed that people engaged with the installations in a variety of ways. For example, submitting messages, and reading messages provided by others proved particularly popular. However, it also emerged that people experienced several barriers to participation, including barriers related to privacy, a lack of time, and the constraints imposed by the



installations. Both the types of engagements and barriers are described in detail in the following sections, followed by an analysis of the engagement with the visualisations – which were noticed and interacted with by far fewer people.

#### 8.4.1 Curiosity

All 14 interviewees had seen one or more installations, with all 14 having seen the installations in the foyer, 5 having seen the installations in the graduate room, and 3 having seen the installations in the 4th floor hallway. The participants had first noticed the installations in the foyer of the building. The security guard present in the foyer during most of the deployment explained: *“When people came in, they noticed something different in the foyer and they would be like ‘What is this?’ . The first few days they just looked at what was there and they didn’t do anything, but then after a few days, they read what other contributions others had done, and I realised that people were staring at it and trying to put some comments on it.”* [P11]. Several participants brought up that it took them time to realise what the installations were for (e.g. *I didn’t approach [the installation] because I assumed that it’s got nothing to do with me.* [P8]). Another participant explained: *“I think, when I first noticed it, I probably thought [the installation with tags] was something about keys or something that had nothing to do with me”*. When, a few days later, she noticed another installation, the following happened: *“I did notice [the magnet installation] and I looked at it once, [but] I couldn’t figure out what to do with it. It felt like something stressful, so I ignored it. A couple of days ago I did try it because I thought I’d figure it out.”* [P6].

#### 8.4.2 Viewings

Most participants spent time reading messages left by others (e.g. *“I was just curious what people were writing.”* [P11]), which many described as a positive experience (e.g. *“It was just nice to see that other people had been there and what they were thinking [...] I did read all of them, and I quite liked seeing other people’s voices up there.”* [P5], *“I did read what other people wrote. Some were interesting, some were funny.”* [P6]). One participant described that there were *“quite good ideas, like showers for cyclists, bicycle sheds for the cyclists, too noisy hand dryers [...], and other things.”* [P3]. Several other participants also recalled one or more messages they had read and found interesting, and one participant explained that one of the messages even changed her behaviour: *“The one [message] about the hand dryers has made me more aware and now I don’t use that toilet next to that desk — I use the one on the far [end], because I am aware... it has made me a bit more considerate I suppose. I am aware that that is an annoying noise for someone else.”* [P8].

Period	Question	Foyer		Graduate room		Hallway		Total
1	Q1	Scribbles	8	Typewriter	8	Magnets	9	25
2	Q2	Typewriter	56	Magnets	10	Scribbles	0	66
3	Q3	Magnets	33	Scribbles	1	Typewriter	2	36
4	Q4	Scribbles	5	Typewriter	13	Magnets	12	30
5	Q5	Typewriter	27	Magnets	8	Scribbles	0	35
6	Q6	Magnets	26	Scribbles	0	Typewriter	4	30
Total			155		40		27	222

**Table 8.3:** Overview of messages submitted via the three installations, at the three different locations

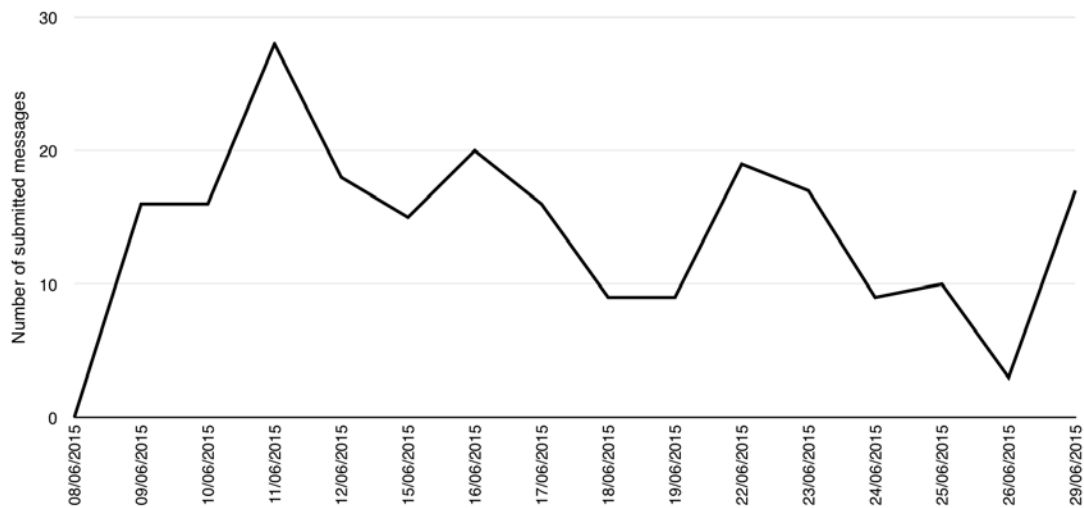
### 8.4.3 Discourse

While it was not a regular occurrence, during the deployment small groups (typically 2 to 3 people) were observed talking about the installations while standing near one of the installations. The vast majority of these conversations took place in the foyer, usually during the day, when people would enter and leave the building to go for lunch. Of the interviewed participants, eight indicated they had not discussed the installations with other people, neither the content nor the input method. The primary reason given for this was that they came across the installations upon entering or exiting the building, while they were on their way (e.g. “*Most of the time I interacted with it when I was leaving the office and then I would just go out and immediately forget about it.*” [P12]). Six participants did discuss the installations with others, of whom four discussed the input method (e.g. discussing using a similar technology for another project, discussing how difficult it was to create sentences with the magnets, etc.) and three discussed the content (e.g. telling colleagues about messages they had read, talking about the air conditioning of the building, etc.).

### 8.4.4 Submissions

A total of 222 messages were submitted via the three installations, of which 14 were submitted via the Scribbles installation, 110 via the Typewriter and 98 via the Magnets (see Table 8.3). The majority of these messages (155) were submitted via installations placed in the foyer of the building. Fewer were submitted in the graduate room (40 messages), followed by the hallway (27 messages). An average of 13.9 messages were submitted per day ( $\sigma = 6.9$ ), with the fourth day of the deployment receiving the highest number of submissions – a total of 28. On the first day of the deployment, no messages were submitted. As

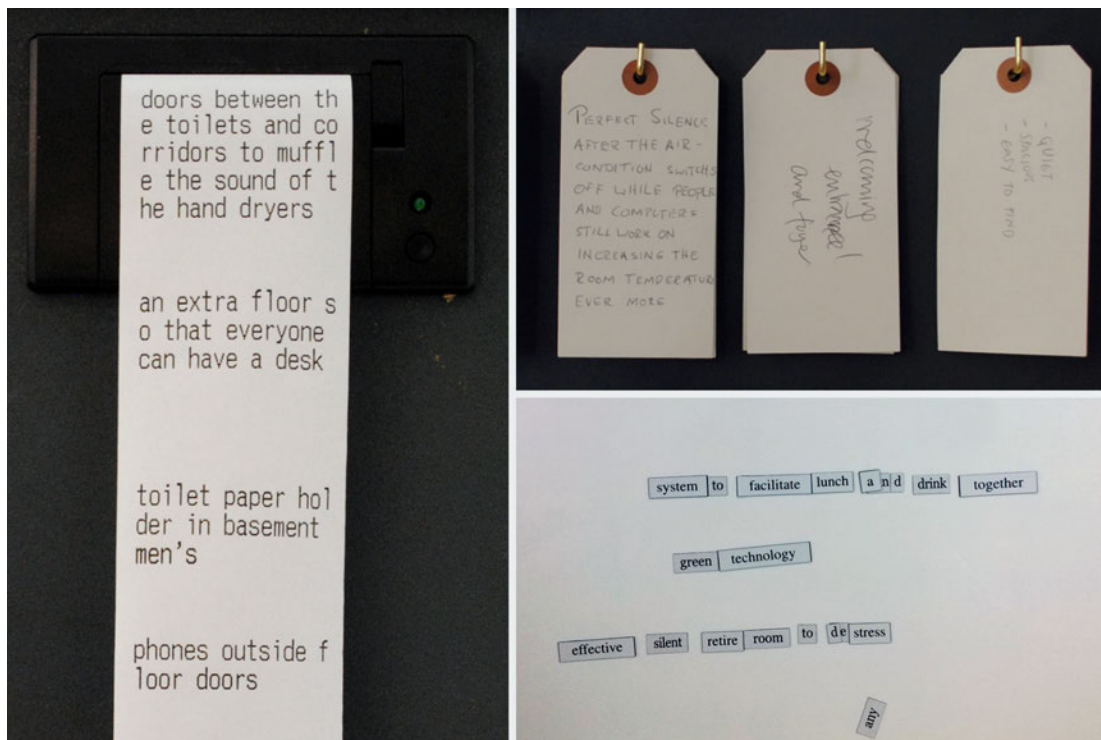
described previously, from the interviews it emerged that many people were unsure what to with the installations at the start. Additional reasons for this ‘slow start’ will be discussed in the upcoming sections.



**Figure 8.5:** Messages per day

During the deployment, a total of 38 messages were submitted between 09:00 and 13:00. A further 65 messages were submitted between 13:00 and 17:00. The majority of the messages, however, were submitted outside the usual working hours — a total of 119 messages. These messages were submitted between 17:00 and 09:00 the next day. Both the Typewriter’s log file data and observations during the deployment suggested that the evening hours were the most popular submission time. Messages submitted via the Scribbles installation were on average 78.8 characters long ( $\sigma = 72.4$ ), compared to an average of 29.9 characters via the Typewriter ( $\sigma = 22.3$ ), and 23.2 characters via the Magnets ( $\sigma = 14.3$ ). Several example messages are shown in Figure 8.6.

During the deployment, messages irrelevant to the posed question were submitted via all installations (for example: “hello?”, “ggff”, “bath monkey”). Of the messages submitted to the Scribbles installation, 14.3% were identified as irrelevant, compared to 18.2% of the Typewriter, and 67.3% of the Magnets installation. A sample of 50 messages was coded by two judges to determine inter-rater agreement, with the aim of establishing whether the identification of irrelevant messages was conducted correctly. Each message was coded as either ‘relevant’ or ‘irrelevant’ to the question posed. This revealed a Cohen’s Kappa coef-



**Figure 8.6:** Example messages

ficient of 0.80, showing substantial agreement (Viera et al., 2005). The irrelevant messages were excluded from further analysis.

The thematic analysis that was conducted on the relevant messages revealed that the content submitted via the three installations contained many similarities. Again, a sample of 100 messages was coded by two judges to determine inter-rater agreement, and to establish whether the assignment of themes was conducted correctly. A list of the 7 themes that emerged from the thematic analysis was provided for the coding. The comparison revealed a Cohen's Kappa coefficient of 0.88, showing almost perfect agreement between the judges (Viera et al., 2005). The most popular topics included the workspaces in the building, furniture, the bathrooms, climate control, and the people. Some of these topics were raised via all three installations, as shown in Table 8.4. Overall, however, the Magnets and Typewriter installations, the two installations that also received most contributions, collected the most diverse messages.

Of the 14 interviewees, 8 had contributed to the installations by leaving a message. All participants who had contributed messages expressed a strong preference for the Typewriter, describing the process of contributing via the Typewriter as enjoyable (e.g. *"I just found it more fun to answer the one that had a printer with it."* [P1], *"It was a new experience, usually you have to*

Theme	Urban Scribbles	Urban Magnets	Urban Typewriter
Bathrooms			•
Climate control		•	•
Drinks and food			•
Furniture	•	•	•
People	•	•	•
Technology		•	•
Workspaces	•	•	•

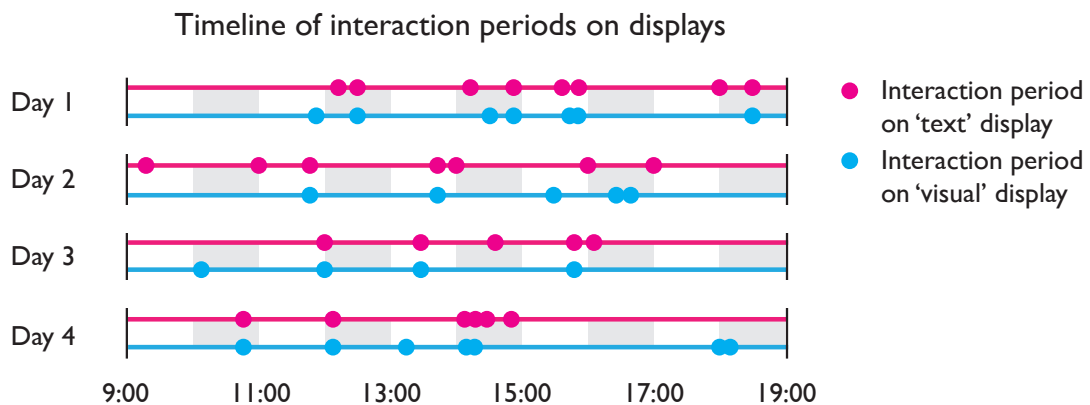
**Table 8.4:** Main themes in messages

write, and this was something new,” [P11]) and easy (e.g. “It was easy to use.” [P6], “I answered only via the one with the printer, because that one was easier.” [P1]).

From the interviews, it emerged that participants also experienced several barriers to participation, which are described in more detail in the following sections.

#### 8.4.4.1 Visualisations

Over the course of the four days during which the displays were deployed, all interactions with the visualisations were logged (see Figure 8.7).

**Figure 8.7:** Timeline of interactions with display

On the ‘text’ display, a total of 293 interactions were recorded, distributed over 26 unique interaction periods. On average, 11.3 interactions took place per period ( $\sigma = 13.3$ ). On the ‘visual’ display, 184 interactions were recorded, of which 155 were interactions to reveal contributions (i.e. block presses), and 29 to navigate between questions (i.e. arrow presses). These interactions were divided over 23 unique interaction periods. On average, 8 interactions took place per period ( $\sigma = 10.1$ ). The distribution of interactions over the six different questions can be found in Table 8.5.

	Q1	Q2	Q3	Q4	Q5	Q6	Total
Interactions	67	62	10	6	18	21	184
Of which block presses	3	4	8	4	4	6	29
Of which arrow presses	64	58	2	2	14	15	155

**Table 8.5:** Number of interactions per question on the ‘visual’ display

As shown in Figure 8.7, 13 interaction sessions on the two displays took place within the same timeframe, likely indicating that the same individual(s) interacted with the displays simultaneously or in quick succession. This suggests that at most 36 individuals or groups of people interacted with the displays (26 sessions on ‘text’ display plus 23 sessions on ‘visual’ display minus 13 overlapping interactions).

Out of the 14 people who were interviewed, 7 people indicated to have seen the displays, while the other half had not noticed them. The objective of the displays was not immediately clear to all of those who did see them (e.g. *“I thought it was some input [device] or something but then I saw that it was displaying things.”* [P6]). One participant described the difference between the two displays as follows: *“I think the second one with more colours [i.e. ‘visual’ display] was more playful, but the first one [i.e. ‘text’ display] was more interesting because you could just see these citations and be like “oh, okay, so somebody else wrote something about the air-condition as well”.’* [P2]. No clear preference for either the ‘text’ or ‘visual’ display emerged from the interviews. Although some people enjoyed *“just scrolling through”* [P6] the contributions using the ‘text’ display, others appreciated the overview nature of the ‘visual’ display (e.g. *“I thought the colour ones were more fun. I like stats more.”* [P12]).

## 8.4.5 Barriers to participation

### 8.4.5.1 Time

Of the 14 participants who were interviewed, 7 brought up that a lack of time played an important part in why they did not engage with the installations frequently. For example, some noticed the installations, or changes to the installations, but could not afford the time to look (e.g. *“I did see something yesterday, but I didn’t stop to look at them because I was in a hurry.”* [P6]). For others, time restrictions meant that they read other people’s messages, but did not contribute personally (e.g. *“At that point I didn’t add anything, because I didn’t have the time.”* [P1]). This lack of time was primarily associated with the installation placed in

the foyer, which people walked past upon entering or exiting the building (e.g. *“When I am leaving I am either in a hurry to get somewhere or when I am coming I am in a hurry to get in.”* [P6], *“I saw them on my way home, and obviously I am always on the way to go pick up my children, so I don’t really have much time to offer.”* [P8]).

#### 8.4.5.2 Lack of existing messages

At the start of each period, all contributions on the installations were removed to make space for new answers and to avoid confusion between answers relating to older questions. However, this ‘clean’ look proved to be a barrier to participation for some. For example, one participant said: *“I wasn’t very much motivated, because this one [Scribbles] was upstairs [...] and nobody wrote anything. That also contributed. Whereas the one here [Typewriter] was at the entrance and other people had already written something. So, being the first to submit a comment is always something... it’s a barrier.”* [P3]. Another participant experienced a similar feeling with the Scribbles installation: *“The handwritten one, when I saw it, it was like really clean and there wasn’t anything yet, so it felt a bit like... Can I do this? Should I do this? And my first reaction was like “No.”. But then I thought I’d just leave a message and see what happens. Because it was so nice and clean I wasn’t really sure what to do. So maybe if there were some example messages showing that “Yes, you can interact with it”. Then again, it didn’t stop me in the end.”* [P12].

#### 8.4.5.3 Lack of anonymity

From the interviews it emerged that several people worried that they would be personally linked to the messages they left on the installations, which prevented some from submitting. One participant expressed not feeling motivated to answer via the Scribbles installation because *“then you see [my] handwriting”* [P3]. As a result, he preferred the Typewriter: *“This one was better because it was easier for a short anonymous input.”* He explained that such anonymity is important because *“If you mail [them] it is not anonymous. A criticism that goes beyond a detail, like the coat hooks, could be interpreted as an attack to fault the planning by the people in charge.”* Another participant felt wary about the anonymity of all installations, explaining that *“There were not that many people here [in the building]. So I thought, if I write something, people will notice that it was me. [...] I thought that if there were more people, I would be more anonymous.”* [P13]. For others, these concerns only played a role when other people were in close proximity (e.g. *“If there are people around and they can see what I was putting and that it was connected to me, I would feel a bit uncomfortable.”* [P5]).

#### 8.4.5.4 The presence of other people

The locations where the installations were deployed enabled all people in the building to notice the installations. However, the downside was that these locations were often busy — particularly during lunchtime and at the end of the working day. During the interviews, people mentioned wanting to be alone while submitting messages. One person explained that she was alone while writing a contribution, adding, *“I quite liked being alone. I don’t think I would have done it if there were other people around [...] I would probably censor my answer.”* [P5]. Another participant described leaving when someone walked past, and then deciding to write her message in her own office: *‘I was leaving the office one evening and there was nobody in the foyer, so I thought “This is the right time to pick it up and write something”. And the moment I got there, somebody was walking up from the basement. So I left it, I just thought “It’s the end of the day, I’ll do it another time”. And then the day after, on entering [...] I picked a card [and took it to my office] and then at the end of the day I filled it in and when I left my office in the evening I just quickly left my card there.’* [P4]. While she managed to avoid the presence of others by taking the tag to her office, this was not an option for the other two installations, which she therefore did not contribute to (*“Because both forced me to stay there. [...] I didn’t feel like staying physically there.”*). Another participant linked the desire to be alone to voting during elections: *“When you elect you are always alone. And I think electing in general is a really private use case [...]. I am aware of the fact that especially public installations, they aim to [...] foster crowd interaction [...], but I still had the feeling that I should be alone and I wanted to focus and make a good choice.”* [P10].

#### 8.4.5.5 Limited expressiveness

The level of constraint in expressiveness between the installations proved a key point of discussion during the interviews. Especially the limitations imposed by the magnets were addressed by many participants. Some explained having given up (e.g. *“I needed to construct a sentence, but I was short of a few words so [I gave up].”* [P11], *“I tried answering the one with the magnets, but it was just too difficult. And maybe that was the purpose of the installation, to work with those constraints, but... there were too many constraints, it was too difficult.”* [P1]), others expressed finding the process somewhat enjoyable: *“It was much more difficult with the magnets because you have to sort through [the words]. You end up giving quite an abstract answer. But it was quite fun. I could answer the question in a way that had meaning for me, but I don’t think it necessarily communicated my feelings to somebody else.”* [P5]. The presence of such ‘meaningless’ sentences was raised by sev-



eral participants (e.g. *“With the magnets, some [messages] did not make any sense.”* [P1]). For some people, this meant that they became disinterested in reading contributions (e.g. *“I actually read [the messages], [but] the first one didn’t make any sense [...]. So then I didn’t try again.”* [P4]), while others read them for the purpose of entertainment (e.g. *“It was nice to read what other people wrote, but it was kind of... I didn’t take [it] so serious [sic].”* [P14]).

Furthermore, one participant was unsure whether a collection of words formed a sentence, or whether their placement was unintentional: *“It wasn’t so easy to understand if other people had already answered or if it was the way the magnets had gone up.”* [P8]. Therefore, she had decided to move the words aside, and to add her message in the middle. This moving of words was brought up by several participants, some whom decided not to contribute because of this (e.g. *“I was thinking, if I were to contribute something, my thought was lost, because someone else can change it.”* [P14], *“Someone might take your words and put it in their sentence, so your word is missing”* [P8]). Another participant concluded that this made the installation less serious: *“I wasn’t sure if other people would move it again, so [it] was more like a game, rather than a method of giving serious input.”* [P3]. One participant also explained that he did not participate because he felt that his input would likely have little effect: *“I guess I also thought that most of the big decision about this building have been taken already. And the investment has been done, so... I guess whatever I say in there is not... no major impact, so I guess that is the reason. If I had been asked beforehand, [...] there is a higher chance that I would have participated.”* [P9].

## 8.5 Discussion

The main focus of this case study was on the exploration of different textual input mechanisms, instant display of the collected data, and the effectiveness of central interactive visualisations in a workplace setting. The findings from this investigation are discussed below, followed by a description of the identified types of engagement, and the design and contextual factors affecting this engagement.

**SMT RQ1: How does the use of textual input technology affect engagement and contribution quality?**

The use of textual input technology was investigated with the aim of facilitating the submission of more in-depth data – intended to make people engage more with the topic. The

findings revealed that engagement differed greatly between the three textual input technologies, with the Typewriter receiving the highest number of messages, and the most diverse messages. During the interviews, this installation was also found to be most engaging. Key to the Typewriter's success in engaging people was found to be its novelty, providing people with a different way of providing feedback, ease of use, anonymity, and its unrestricted nature – allowing people to submit any type of textual message. The contribution quality was also found to differ between installations, with the Scribbles installation receiving the highest quality submissions.

**SMT RQ2: How does the immediate public display of the collected raw data affect engagement?**

All three installations directly displayed all messages upon submission, with the aim of engaging people in reading and discussing the perceptions of others. In the case of the Magnets and Scribbles installation, this display was an affordance of the input mechanisms, and in the case of the Typewriter a separate printer was used to provide this. Overall, the public display of all submissions was found to be highly engaging, as it successfully encouraged people to notice and read the messages others had submitted. The selected input mechanisms were found to influence the ease with which the displayed messages could be read. The restricted input of the Magnets installation was, for example, found to result in the submission of insensible messages, making the process of reading the submissions less engaging.

**SMT RQ3: How does the display of interactive visualisations affect engagement?**

At the end of the deployment, two interactive visualisations were positioned in the most frequently visited location in the building – the foyer. These visualisations were intended to engage people in exploring themes in the collected data, thereby further encouraging them to read and discuss the perceptions held by others in the building. The findings showed that overall engagement with the visualisations was low, with few people noticing and interacting with the displays. Those who did engage, typically browsed through several visualisations and messages. From the interviews it emerged that the displayed information was found to be interesting. A number of factors likely played a role in this overall lack of engagement with the interactive visualisations, including the timing of the display of visualisations at the

end of the deployment, the short deployment period, and the lack of coupling between the input and visualisations.

### 8.5.1 Lessons learnt

The findings from the deployment show that overall the Urban Typewriter installation performed best: it received most submissions, most diverse submissions, and it was the most positively discussed during the interviews. People expressed that they enjoyed participating via the Typewriter, as the process of contributing was different and unusual, but not to a level where it was merely seen as a game, and most contributions contained serious and relevant feedback. This was an unexpected finding: the input method of typing was expected to be highly familiar and therefore less engaging than, for example, the Magnets installation. However, the coupling between this familiar input method and the novel output (the receipt printer) was found to make the process of interacting enjoyable.

During the study, both the Magnets and Typewriter installations were used frequently. In comparison, the Scribbles installation was far less popular, receiving little attention and few contributions. From the interviews it became apparent that many people found the Magnets installation frustrating to use due to the effort it took to compose a message, and the limited number of available words. As a result, a relatively high number of submissions were also classified as irrelevant, as they were often incomprehensible. Furthermore, due to the limitations of the Magnets, people viewed the installation more as a game than as a serious method of consultation. Again, this was unexpected, as the playful nature of the input method was predicted to foster creativity and encourage participation. Instead, the study revealed that the level of constraint needs to be carefully considered in order to achieve the right balance of expressiveness and playfulness.

The messages submitted using the three installations did not differ significantly in length, although on average – as expected – the Scribbles messages were longer than those submitted via the other installations. The Scribbles and Typewriter installation received a comparable percentage of irrelevant messages, while the magnets received far more. While there was overlap in the themes that were addressed via the installations, the Magnets and, in particular, the Typewriter installation received the most diverse messages. This diversity may be related to the fact that these installations also received the largest number of submissions.

While the Typewriter performed best, the study also revealed that several aspects of the installation had to be adjusted or reconsidered. For example, people expressed being wary of leaving the first message, and experienced a lack of contributions as a barrier to participation. By providing a prompt or example message, this issue may be overcome. Furthermore, people were conscious of the presence of others, and sometimes hesitant to contribute in case they would be personally identified as the writer of their message. While this confirms that people should be able to contribute anonymously, it also raises a concern for privacy that did not play a role in the previous Visualising Mill Road, Fair Numbers, or VoxBox deployments. This suggests that the specific context, i.e. the workplace, may have played a role in evoking such privacy concerns, potentially due to the work relationships people have with one another within this environment, and the consequences that criticism towards others may have. The study, however, does not provide insight into the extent to which privacy concerns affect engagement when people provide qualitative feedback in a community setting.

It also revealed the importance of the setting in which the device is placed, with the foyer – the setting with most footfall and space to facilitate congregation – receiving far more contributions than the two other locations. The findings from the interviews also highlighted the importance of embedding the interactions into people's existing rhythms and routines. In other words, the installation should enable people to come across it at the right time and at the right place, when they are able to fit the interaction into their day – for example, after normal working hours.

The visualisations were deployed for a shorter period of time, and they received less attention on the whole. The interviews revealed that only half of the people had noticed the visualisations, and few had interacted with them. The number of interactions with both visualisations was highly comparable and often overlapping. While the interviews did not provide many insights into the engagement – or lack of engagement – with the visualisations, a more direct link between the input installations and visualisations (i.e. co-locating the two, and displaying the visualisations simultaneously) would have likely increased people's awareness of the existence of the visualisations, seeing as most people did notice the input installations.

It should also be noted that the deployment took place in a university setting, specifically a Computer Science department. This likely affected the findings, as the people in this environment are highly familiar with technology, and therefore potentially more interested in the most novel installation: the Typewriter. Furthermore, in a university setting people are typically also highly familiar with experimental installation – unlike people in normal residential environments – which may have affected the ecological validity of the findings.

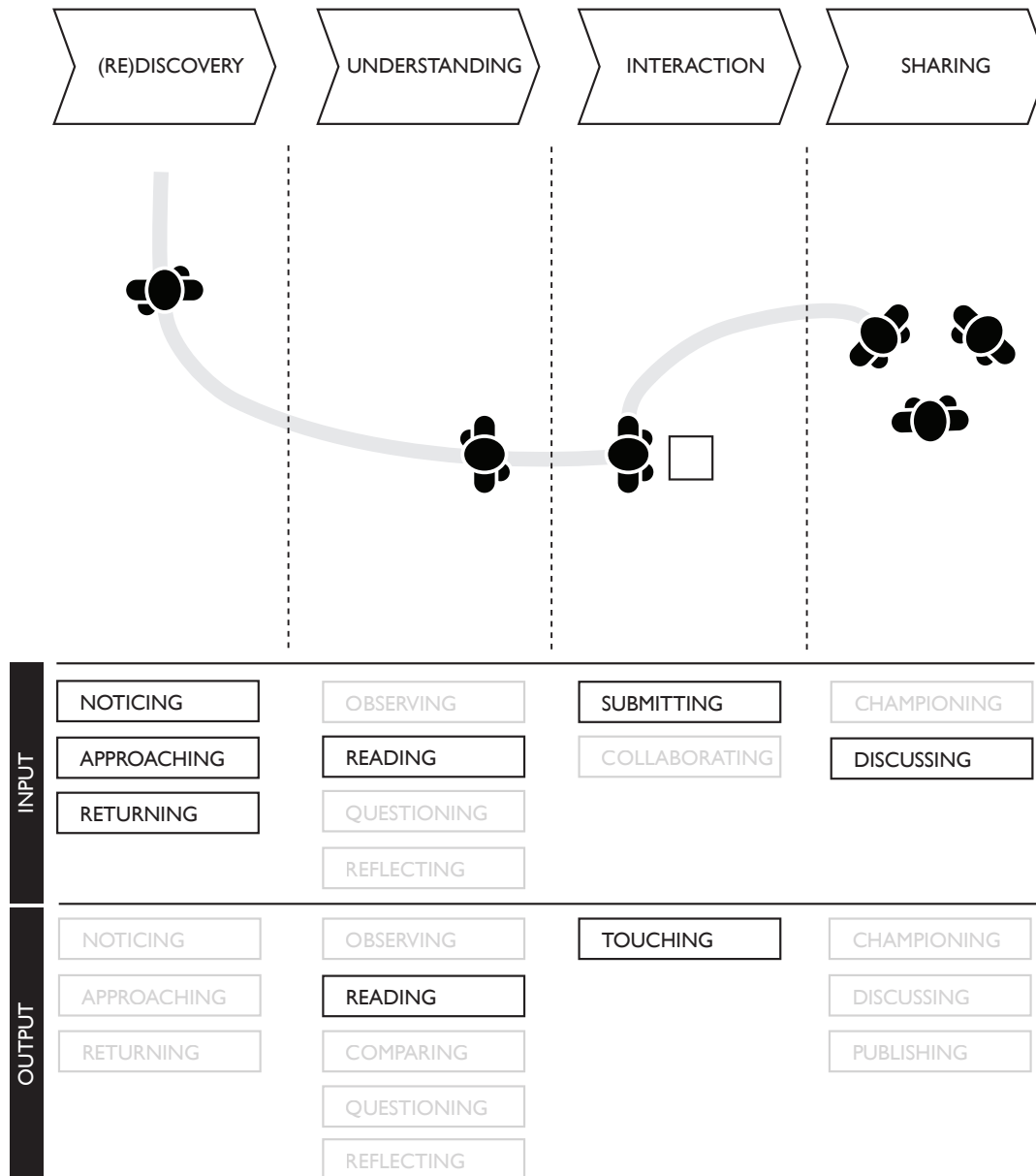
The lessons learnt from the deployment informed the design of the installation aimed at a residential community. The next installation was coined the Urban Typewriter, as it was an iteration of the keyboard and printer prototype used during the study. The following chapter describes how the installation was designed, deployed, and evaluated in a residential setting.

### 8.5.2 Types of engagement

The deployment of the Scribbles, Magnets, and Typewriter installations evoked a variety of engagement behaviours, as shown in Figure 8.8. As described below, the four engagement stages were again found to typically occur in consecutively. However, the study also revealed that some people moved through the different stages at a relatively slow pace – with some people for example explaining that several days passed between initial discovery and understanding.

In the discovery stage, people **noticed** the input installations. The findings revealed that this mainly occurred in the most visited deployment location, the foyer, with few noticing the installations in the other two locations. Upon noticing one of the installations, some **approached** the device to further inspect it. The study also showed that others, however, did not approach immediately and instead only inspected the installation several days later. From the interviews it became apparent that those who approached the devices often also **returned** again at a later stage in order to read the added message, or to contribute feedback. In comparison, the visualisations were found to be far less engaging, with few people noticing them, approaching them, or returning to them.

In the understanding stage, people **read** the posed questions, and the messages submitted by others, to learn more about the installations as well as the perceptions of other people. Few people observed others interacting with the installation, and similarly, only on very few occasions people were observed questioning others about the devices. Again, in comparison,



**Figure 8.8:** Types of engagement with the input technology and output visualisations

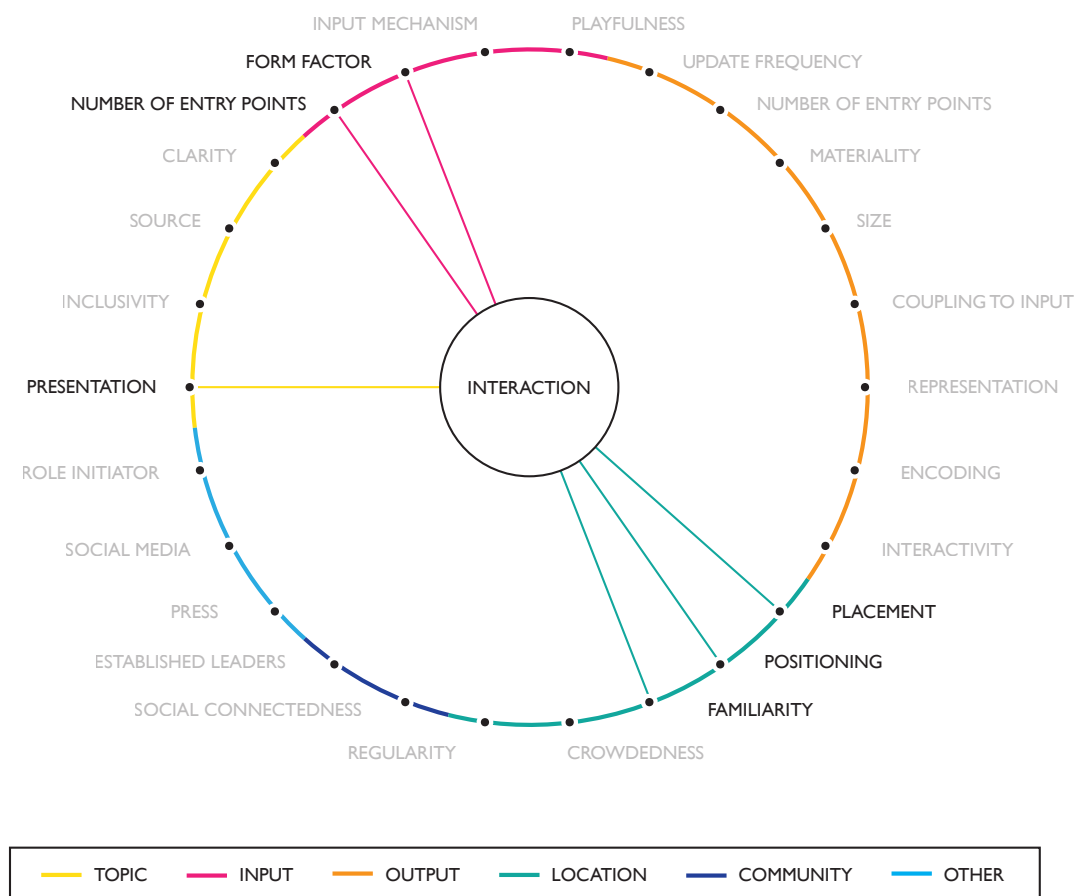
the visualisations were found to be far less engaging, with the interviews revealing that few people read the displayed data or engaged in any other way.

In the interaction stage, people **submitted** content to one of the installations using the available input mechanisms. People were not observed collaborating. Those who noticed and approached the visualisations were observed **touching** the screens in order to explore the data.

In the sharing stage, people **discussed** either the input methods, addressed topics, or displayed content. The visualisations were not found to elicit discourse. People were also not observed actively championing the installations, or publishing information about the project on online or offline platforms.

### 8.5.3 Design and contextual factors

#### 8.5.3.1 Discovery and rediscovery



**Figure 8.9:** Factors framework: factors relating to discovery

#### Presentation of topics

Topics were presented consecutively, with a new question being revealed every few days. Similar to the findings from the Visualising Mill Road case study (Chapter 4), this approach was found to promote rediscovery, as it encouraged people to return to the installations to view and respond to the latest questions.

#### Number of entry points

Multiple entry points were provided in order to increase the chances of people noticing

the intervention. The findings showed, however, that while this distribution of technology facilitated some additional discovery, the vast majority of people noticed and approached the installations located in the building's most frequently visited location (see Placement).

### **Form factor**

The form factor of the installations, consisting of large grey and yellow panels and the different input mechanisms, was found to stand out in the environment. As a result of this, many people noticed the installations. The familiarity of the environment played an important role in this (see Familiarity of location).

### **Placement**

The input technology was placed in three different locations, with the aim of reaching people throughout the building and increasing the chances of people discovering the installations. The findings revealed, however, that unlike the Visualising Mill Road study (Chapter 4), this distribution was only somewhat successful: the vast majority of engagement took place in the building's most regularly visited location – the foyer near the entrance and exit. In comparison, the other two locations encouraged little discovery, likely due to their relative quietness. This further emphasises the importance of placement in key locations that are part of people's existing routines.

### **Positioning**

The positioning of the installations along main walkways and next to doors facilitated discovery, as it increased the likelihood of people noticing the intervention while walking through the building.

### **Familiarity of location**

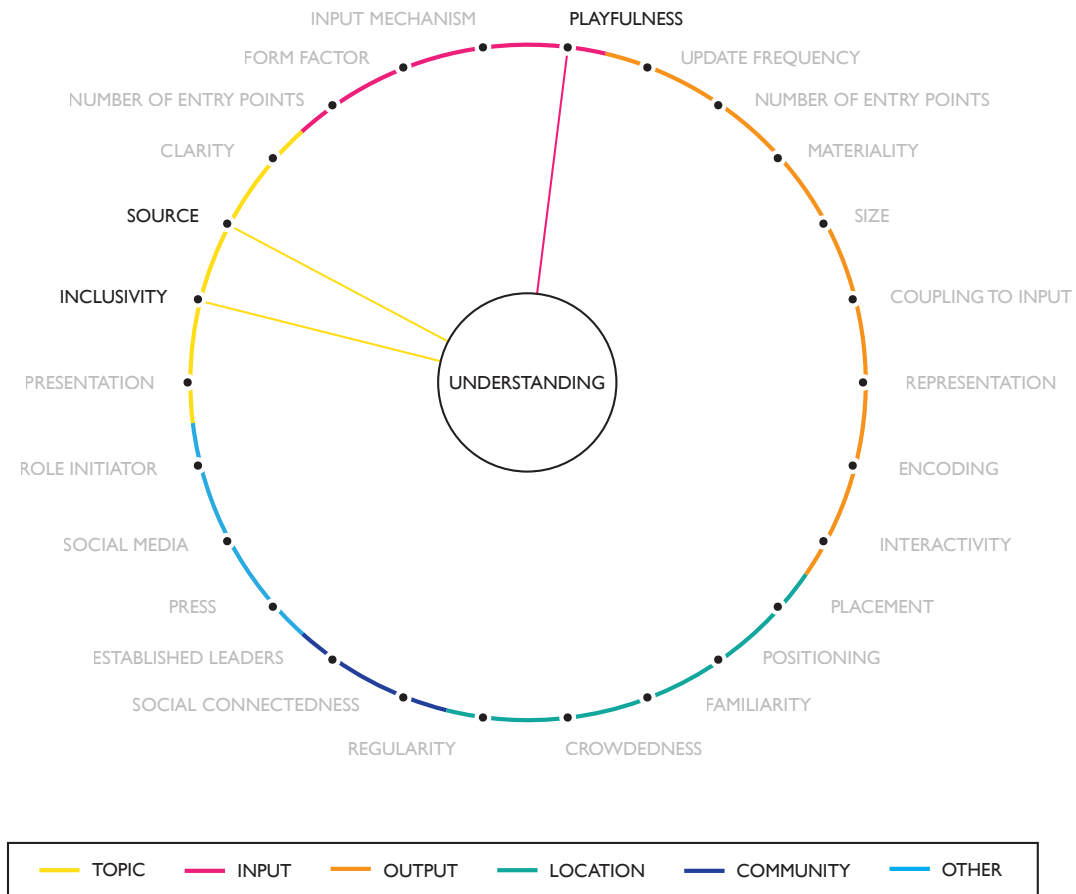
While the people in the building had moved to these new offices only several weeks before the deployment, they were typically highly familiar with the building as they worked in it on a daily basis. Because of this, the arrival of the installations was noticed immediately by many people.

#### **8.5.3.2 Understanding**

##### **Inclusivity**

The questions posed by the installations were not designed to be accessible by all. Instead, they were meant to primarily address the students and staff members working in the build-





**Figure 8.10:** Factors framework: factors relating to understanding

ing – not necessarily visitors or other people unfamiliar with the new environment, moving process, and the previous office. This approach was found to provide sufficient understanding for people working in the building, who were able to comprehend the posed questions based on their pre-existing knowledge (e.g. understanding references to the moving process).

### Topic source

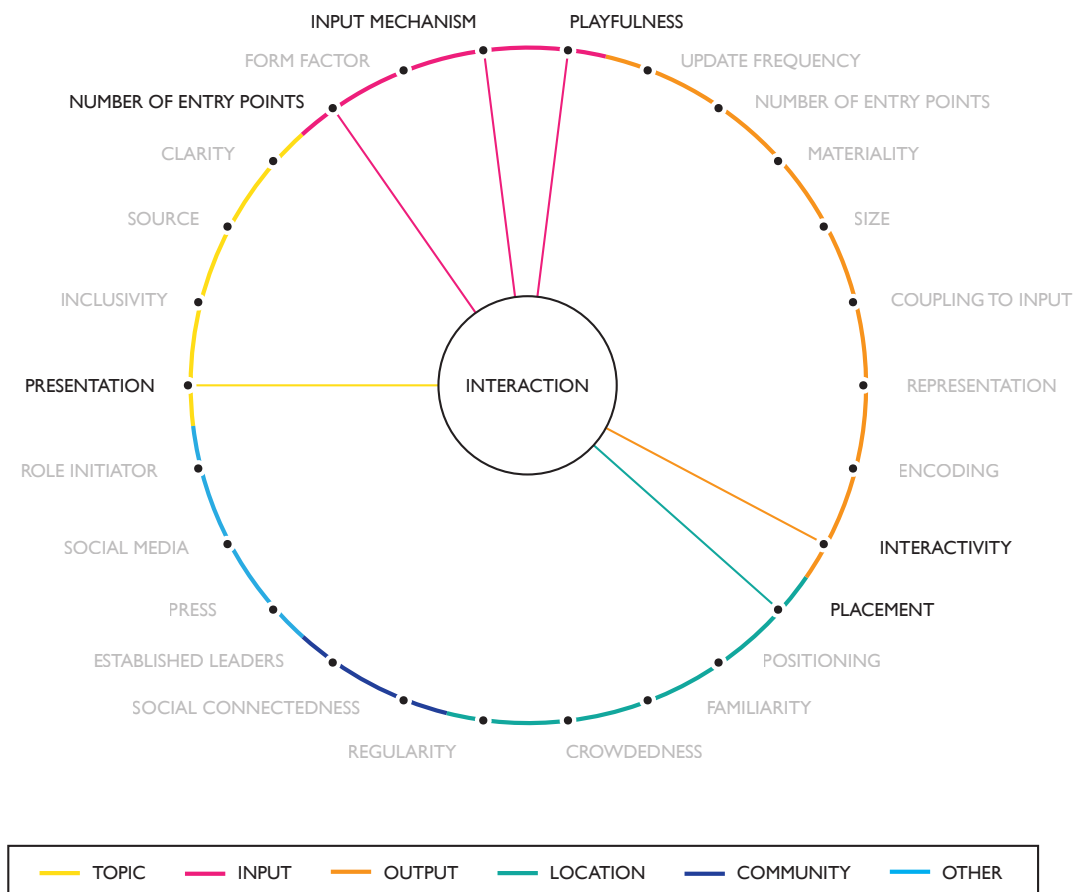
All topics were suggested by staff members. This approach, again, ensured that people working in the building were able to understand and answer the questions – as evidenced by the number of relevant submissions, the responses during the interviews, and the lack of observed confusion. The involvement of locals was partly informed by the success of the Visualising Mill Road study (Chapter 4), and this finding further highlights the importance of knowledgeable topic sources.

### Playfulness

The playfulness of one of the installations, the Magnets installation, was found to hinder

understanding. The messages produced using this installation were regularly incomprehensible to others. As a result, people were found to be discouraged to engage with the input and output.

### 8.5.3.3 Interaction



**Figure 8.11:** Factors framework: factors relating to interaction

### Presentation of topics

The consecutive presentation topics was designed to motivate people to return to the installations to take part again. The interviews revealed that this successfully encouraged some to return multiple times and to interact multiple times, each time answering a different question.

### Number of entry points

By deploying three installations, three entry points were created via which people could interact. The findings showed that all three entry points were used throughout the deploy-

ment, albeit at different levels. The input mechanism and placement of the installations were found to play a key role in this, rather than the number of entry points.

### **Input mechanism**

The constraints imposed by the input mechanisms were found to limit people's expressiveness to an extent where it acted as a barrier to participation. The Magnets installation, in particular, was found to be too restrictive and therefore unsuitable for the communication of feedback. Furthermore, the Scribbles installation, which asked people to submit handwritten feedback, was described as too much effort and uninteresting. As a result, this installation also discouraged interactions. The Typewriter, however, was generally found to be an effective and enjoyable input mechanism, and was used frequently in comparison.

### **Playfulness of input**

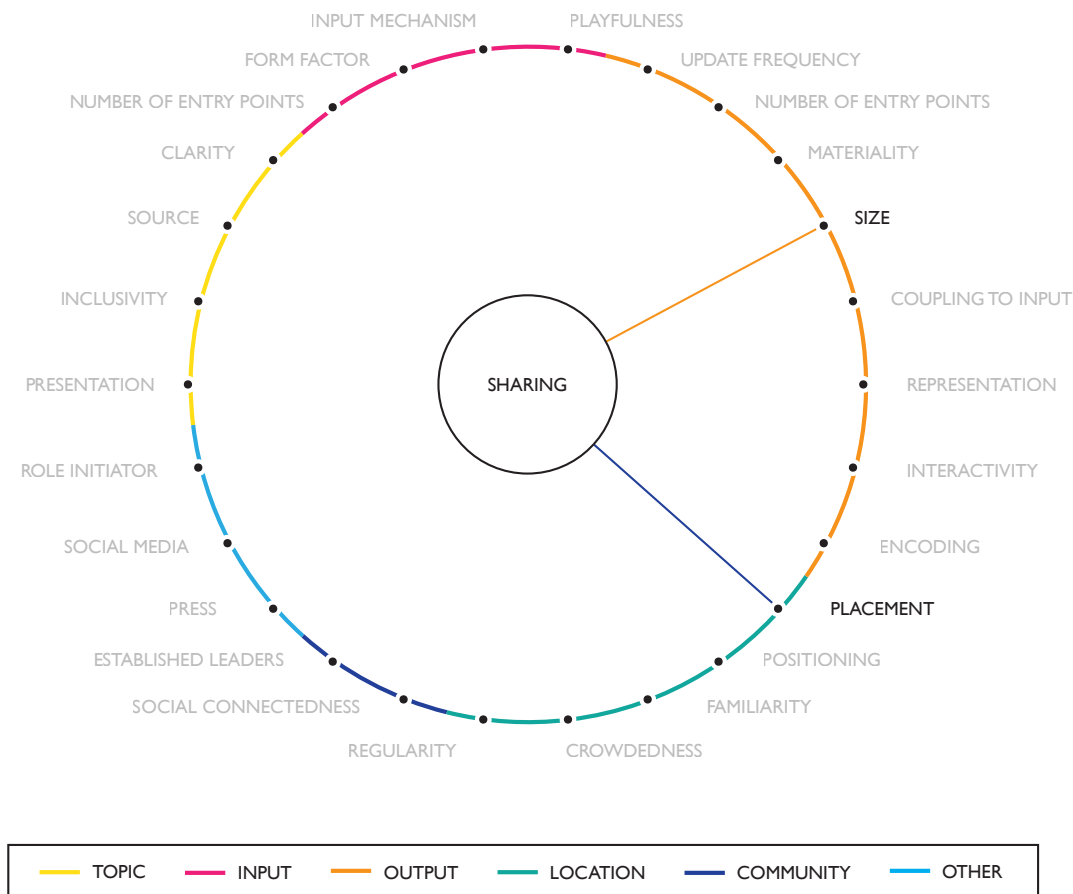
The study revealed that some of the input mechanisms, as well as the contributed messages, were deemed to be too playful by some – who as a result viewed the installation more as a game than a serious feedback method. From the interviews it emerged, for example, that the use of fridge magnets as input was found to be too playful, because of which people decided either not to interact or to interact with one of the other installations. This highlights an important balance that needs to be achieved between playfulness and usability.

### **Interactivity of output**

The use of tablets for the output communicated to passers-by that the visualisations were interactive. This successfully encouraged people to touch the displays to explore the visualised data.

### **Placement**

The placement of the installations was found to both foster and hinder interactions. Their placement near the entrance and exit was found to, on the one hand, encourage interactions, as people came across the installations on a daily basis, which reminded them to take part. On the other hand, people were typically in the process of entering or leaving the building when passing the devices, because of which people expressed not having time to interact then and there. Furthermore, there was relatively high footfall in the foyer, which was found to hinder interactions as people wanted privacy while taking part.



**Figure 8.12:** Factors framework: factors relating to sharing

#### 8.5.3.4 Sharing

##### Size

The form factor of the output, consisting of large vertical displays, enabled people to convene around the installation to collectively discuss the submitted messages.

##### Placement

The placement of installation in key areas in the building allowed people to point out and discuss the devices with colleagues while walking past them.

## 8.6 Summary

This chapter described the design and deployment of three installation with different input mechanisms. These installations were placed in a work setting to evoke feedback from people on their recent move to a new building. The findings revealed that the devices successfully encouraged people to notice them, read submissions, and submit feedback. However, the

study also revealed that people experienced a range of barriers to participation. Concerns about anonymity were found to be a key barrier to participation, with people worrying their submissions would be linked to them personally. As such, some explained they waited for a quiet time before participating, or only interacting with the input devices that provided most anonymity (i.e. not the Scribbles installation). In addition, the limited expressiveness imposed by the Magnets installation was found to be too restrictive, hindering meaningful participation. Overall, the Typewriter was found to perform best, receiving most submissions, most diverse submissions, and being discussed most positively during the interviews.

In the next chapter the lessons from this case study are used to design, build, and deploy a situated installation for public consultations – as part of a collaboration with a London city council.



## Chapter 9

# Case Study VI: Urban Typewriter

### 9.1 Introduction

The collection of opinions from communities is oftentimes necessary for local authorities, such as city councils, as part of their consultations. Such consultations are regulated by the Localism Act 2011<sup>1</sup>, and are a formal requirement when, or sometimes even before, submitting specific planning applications. The aim of consultations is to give people in the local community a chance to have their say about the plans at a stage when “*there is still genuine scope to make changes to proposals.*”<sup>2</sup> When carrying out consultations, local authorities need to allow enough time for people to respond, and they need to ensure that the outcome is “*conscientiously taken into account in finalising any statutory proposals.*”<sup>3</sup> To enable people to voice their opinions, consultations generally focus on collecting qualitative data from communities, as opposed to voting data. Therefore, a combination of paper surveys, online surveys, and workshops is typically used to find out more about the concerns and ideas of locals. Little is known, however, about the role that technology, situated in communities, could play in collecting such consultation feedback, and how visualising the collected data publicly could affect engagement with the consultation process. For example, can situated technology help reach people who would otherwise not take part in the consultation? And can the

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<sup>1</sup>Localism Act 2011, chapter 4, Consultation: <http://www.legislation.gov.uk/ukpga/2011/20/part/6/chapter/4/enacted>

<sup>2</sup>A plain English guide to the Localism Act by the Department for Communities and Local Government, 2011: [http://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/5959/1896534.pdf](http://www.gov.uk/government/uploads/system/uploads/attachment_data/file/5959/1896534.pdf)

<sup>3</sup><http://www.lawgazette.co.uk/law/legal-updates/no-magic-bullet-in-consultation/5048402.fullarticle>

public display of people's contributions motivate others to take part? Moreover, does the display of the submitted messages help create a more transparent consultation process?

This chapter describes the design, deployment and evaluation of the Urban Typewriter – a device that collects and displays qualitative input – in a residential community. In collaboration with Croydon Council, the Urban Typewriter was used as part of the council's consultation on the future of a local park. The deployment was used to examine how open-ended questions can affect engagement and to study engagement with the device in more detail. While the Visualising Mill Road study provided initial insights into community participation in a residential area, the approach did not allow for detailed observation of interactions due to the distributed nature of the deployment. It was therefore decided that the final deployment would focus on the in-depth analysis of interactions in a residential community – complementing the VoxBox study of interactions in an event setting.

Based on the findings from the previous studies, the decision was made to design an installation with three key characteristics. Firstly, the installation would enable people to submit qualitative input. The questions were open-ended and the input technology suitable for the submission of messages rather than votes. Secondly, the installation would show all collected data publicly – in its unprocessed form. The aim of displaying this unprocessed data was to give residents insight into what other people had contributed, as well as to provide a clear feedback mechanism – showing people their entries were successfully received by displaying them immediately upon submission. Thirdly, the installation would show visualisations of aggregate data, to enable locals to easily see trends in the data. The design of this installation was first explored in a Scribbles, Magnets, Typewriter study, after which a more robust design was deployed and evaluated in a residential community.

The Urban Typewriter study was a collaboration between Sarah Gallacher, Yvonne Rogers, and the researcher. More information about the collaboration can be found in Section 3.5.

### 9.1.1 Setting

The lessons from the preliminary Scribbles, Magnets, Typewriter study were used to develop and build the Urban Typewriter installation. During this period of designing and building, the researcher reached out to a selection of councils and community groups across London to enquire if they would be interested in making use of a novel situated feedback installation. A handful of community groups expressed interest, and over a period of sev-



eral months both online and face-to-face conversations were held to discuss potential deployments. Croydon Council was one of the organisations who responded, and invited the researcher to their offices to give a presentation on previously conducted research and the latest installation. After this initial meeting, employees of Croydon Council came up with approximately six potential deployment options, all related to their current consultation activities. After discussing these options internally, the council proposed using the installation for one of their upcoming consultations around the regeneration of Ashburton Park, a park located in Woodside, adjacent to Addiscombe – both located in the Borough of Croydon in south London. It was decided that the installation could help with involving more people during the consultation process, and that it could complement the more traditional methods: their planned paper and online surveys.



**Figure 9.1:** Left: Ashburton Park. Right: boarding around the buildings in Ashburton Park

A mansion was built on the site of Ashburton Park in the 18th century, which was then known as Woodside Convent. Over the years, ownership of the building and land changed several times, until both were bought by the Croydon Corporation in 1924, by Compulsory Purchase Order. The majority of the mansion was demolished, and the only remaining part of the building was transformed into a library in 1878. In 2006, this library was relocated to a new building nearby, after which the old building and a nearby kiosk remained unoccupied (as one resident described it: “*They [i.e. the council] let it go to rot.*”) Both the park and these buildings have since suffered from vandalism and neglect. In 2013, local residents initiated ‘The Friends of Ashburton Park’ group, with the aim to “*improve the park along with the public facilities and public buildings within the park perimeter*”. In the following year, the future of Ashburton Park played an important role in the local elections, after an unsuccessful attempt by Croydon Council to sell the building. Since then, the council has started working with The

Friends of Ashburton Park group, and has launched a website to provide the community with park updates, plans, and consultation announcements. The council has also boarded up the original library building and kiosk, and on this boarding a message reads “Croydon Council is working in partnership with the community to regenerate Ashburton Park” followed by a URL to a dedicated Ashburton Park page on the council’s website (as shown in Figure 9.1).

The council’s consultation on both the park and the buildings was finally launched in February 2016, consisting of an online survey, paper survey, and a situated input device – the Urban Typewriter – moving through the area around Ashburton Park. Croydon Council communicated the aim of this consultation as follows <sup>4</sup>:

*“The Council wants to revitalise Ashburton Park and breathe new life into this Historic Park and Garden. We aim to re-establish Ashburton Park as an inclusive, accessible and vibrant Village Green, one which celebrates the heritage and character of the local area, the parks environment and its historic buildings. This will be delivered through improvements to the grounds and renovation of important park assets like the locally listed former convent/library, the Lodge and kiosk pavilion, in order to bring these buildings back into use, to add more diversity and vitality to the park.*

*Rejuvenating this 18.5 acres Park will help it to become a key destination, offering a broad choice of leisure and recreational activities and events, supported by good quality open space, better facilities and refurbished accommodation, helping to create a community hub in the park. The regeneration of Ashburton Park will also support priorities for health and well-being, growth, learning, and social value, which together will help to stimulate the local economy and provide greater opportunities for the wider community. [...]*

*This survey will help us better understand the community’s preferences for the Pavilion and their views on any future activities, events or improvements to the park.”*

The council’s online and paper survey consisted of 14 questions inquiring about how frequently people use the park, and for what purpose, what they believe should happen to the buildings (the Pavilion in particular), and what activities and events they would like to see in

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<sup>4</sup><https://getinvolved.croydon.gov.uk/kms/dmart.aspx?strTab=PublicDMart&PageContext=PublicDMart&PageType=item&DMartId=151&NoIP=1>, accessed March 2016

the park. They were particularly keen to find out from the wider community what activities and events people would like to see, and therefore proposed that this question could be the point of focus for a situated installation.

### 9.1.2 Research objective

The specific research focus of the Urban Typewriter study was on the use of a consultation topic, enabling people to formally have their say in an official council-led consultation. Furthermore, the study was used to examine nomadic textual input technology, and nomadic visualisations (as shown in Figure 9.2). This focus is further detailed below.

CASE STUDY	TOPIC	INPUT	OUTPUT
I: VISUALISING MILL ROAD	COMMUNITY-GENERATED	VOTING (D)	DELAYED UPDATES (D)
II: FAIR NUMBERS	ENVIRONMENTAL	VOTING (D)	REGULAR UPDATES (C)
III: VOXBOX	EVENT FEEDBACK	MIXED (C)	REAL-TIME UPDATES (C)
IV: VOXBOX REAPPROPRIATED	PERSONAL	MIXED (C)	TAKEAWAY (C)
V: SCRIBBLES, MAGNETS, TYPEWRITER	OPEN-ENDED	TEXTUAL (D)	INTERACTIVE (C)
VI: URBAN TYPEWRITER	CONSULTATION	TEXTUAL (N)	DELAYED UPDATES (N)

**Figure 9.2:** Research focus of the Urban Typewriter case study (D = distributed, C = central, N = nomadic)

The Typewriter was designed to consult residents on local topics, through the use of open-ended questions and qualitative input technology, allowing people to provide their perspective or ideas without having to confirm to pre-selected answers (e.g. through voting):

**UT RQ1: How does asking a community for suggestions (i.e. consulting) affect engagement?**

The investigation of a consultation topic was intended to engage people in discussing and submitting their suggestions and concerns in a more in-depth manner, due to the formal nature of the procedure.

The Typewriter's input technology was, again, designed to collect textual contributions, to further investigate how the use of qualitative input mechanisms affect people's engagement and contributions:

**UT RQ2: How does the use of textual input technology affect engagement and contribution quality?**

Similarly, the immediate display of the submitted messages was further examined:

**UT RQ3: How does the immediate display of qualitative contributions affect engagement?**

The direct public display of collected data was, again, intended to encourage people to read and discuss the perceptions of others.

Building on the findings from the Visualising Mill Road study, where engagement with delayed visualisation updates was high, this approach was further investigated:

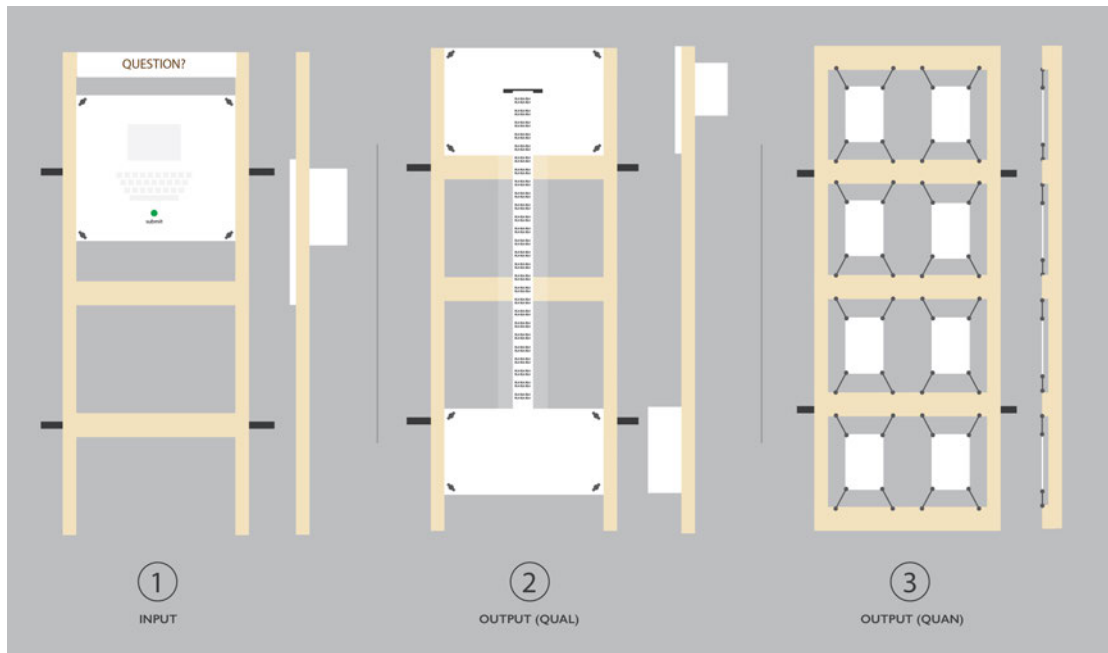
**UT RQ4: How do delayed visualisation updates affect engagement?**

The aim of the use of delayed visualisations was to create anticipation in order to encourage people to regularly revisit the installation to view the latest updates.

## **9.2 Design**

### **9.2.1 Conceptual design**

To gather qualitative feedback from the local community working and living near Ashburton Park, a custom device was built – coined the ‘Urban Typewriter’. Several considerations had to be taken into account during the design process. Key to the study was the use of multiple deployment locations throughout the community, as this approach proved key in the engagement of the wider community in the Visualising Mill Road study. As the objective was to conduct a detailed study of people’s behaviour with the device, it was decided to build a single device that could be deployed and studied at the different locations in sequence – thereby acting as a nomadic device, travelling through the area. To enable this, the device had to be *easy to assemble, disassemble, and transport*. A simple wooden frame was chosen as the basis of the installation, which could fold together into a flat package with the removal of two screws. The use of wood also ensured the installation could be lightweight yet robust, thereby easy to carry and suitable for deployment in public spaces.



**Figure 9.3:** Sketch of Urban Typewriter installation

The study was conducted during a fixed timespan, defined by Croydon Council, at the same time as the paper and online survey were ‘live’ to the public. This consultation period was planned months in advance, and coordinated with several departments within the council, as part of a long-term timescale for the Ashburton Park area. As a result, there was little to no flexibility regarding deployment dates, which made it important to design the device in such a way that any issues could be fixed easily and on the spot, to ensure that the consultation was uninterrupted. For this reason, and based on the experiences with deploying the input devices in the Visualising Mill Road and VoxBox studies, the choice was made to again use simple, easy-to-replace hardware. Furthermore, the installation also had to be a stand-alone device, as it was unknown whether the different locations would be able to provide access to WiFi, mobile reception, or electricity. Therefore, all technology had to consume little energy and require no network connectivity.

The VoxBox deployments revealed that a flat installation, with a front side and a back side, could be a barrier to exploration – as many people did not realise there was more to the installation than just the front side. To overcome this barrier and *make the output more accessible*, a triangular shape was chosen for the Urban Typewriter – to avoid there being a back. Furthermore, the installation was kept open, allowing people to look through it to easily discover the other two panels. This open design also allowed the researcher to keep track of

people at all sides of the installation. The three panels were each dedicated to one component of the installation: the input panel, the data output panel, and the visualisation panel. Therefore, by walking around the installation anti-clockwise, people were able to submit data, view the recently submitted messages, and view visualisations of the aggregate data.

### 9.2.2 Local topics

As the Urban Typewriter was part of the Croydon Council Ashburton Park consultation process, the question the installation addressed was defined by the council. The council opted to focus on one question, which would remain the same throughout the deployment:

Q: What activities and events would you like to see in Ashburton Park?

This same question was also part of their online and paper survey, in addition to a range of other related questions (e.g. “How often do you visit the Ashburton Park?”). They opted to focus on this specific question as it directly addressed the main objective of their consultation: collecting ideas about future use of the park from the wider community. In addition, it was the most open-ended question in their survey, and therefore appropriate for qualitative feedback. The council initially wanted to provide people with multiple choice options, and allow people to explain their choice using a keyboard – as this was also the approach they used via the paper and online survey. However, after consulting the researcher, they decided to go for a completely open-ended approach, where people did not have to choose from a pre-defined list of answers, and instead could submit their own suggestions. The council did insist on listing examples, by adding the following sentence:

This could be activities such as fetes, sport, live music, outdoor cinema or other events

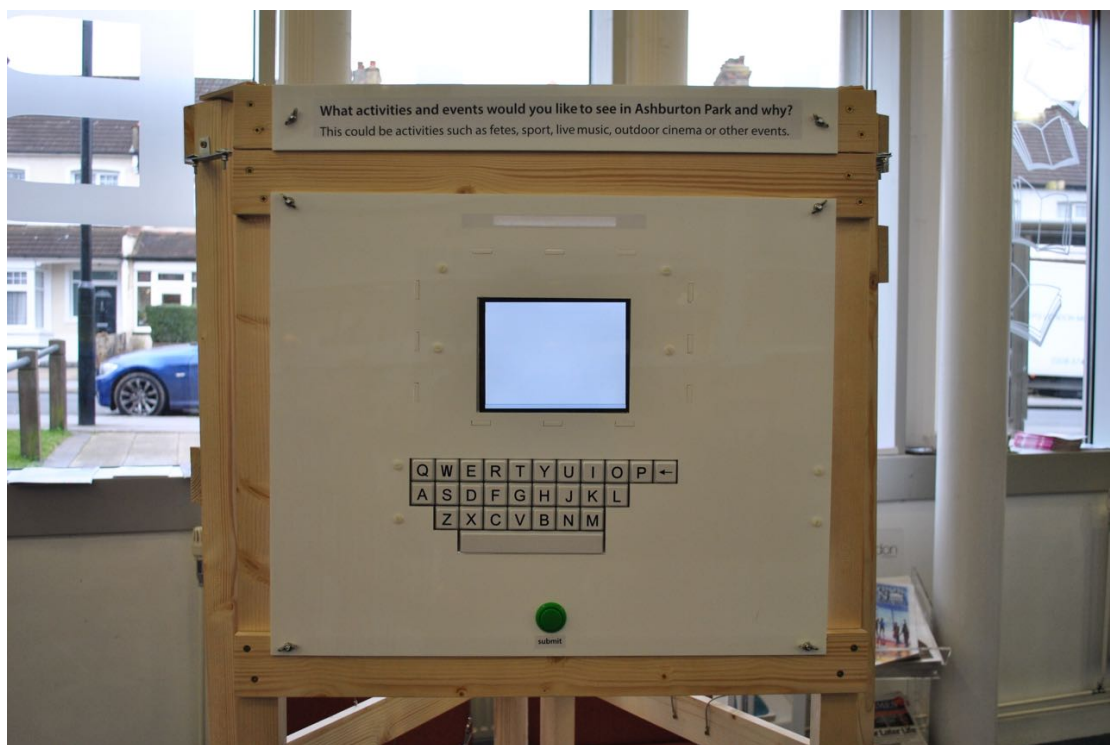
This additional sentence was presented underneath the question. The examples were largely identical to the multiple-choice options presented in the online and paper survey.

### 9.2.3 Input technology design

The front panel served as the input panel, allowing people to provide feedback. At the top of the input panel the question was displayed. The question was printed onto white self adhesive paper and stuck onto a white acrylic background. The positioning of the question

was informed by the findings from the VoxBox study, where the presence of people at the installation blocked the view for passers-by. By making use of a taller installation, and positioning the question in a prominent location, the objective was to make the question visible at all times.

A Raspberry Pi was used as the main computer. A keyboard with extra large keys was connected to the Raspberry Pi, in addition to a green submission button. The keyboard was originally designed for people with visual impairments, and was selected for this installation to increase the accessibility. Furthermore, the objective of using large, noticeable keys was to catch people's attention as they walked past. A 7-inch external screen was also connected, to display what people were typing. A receipt printer was added to print all submissions. The technology was powered by a laptop power bank, which was able to keep the installation running for approximately 18 hours at a time.



**Figure 9.4:** Input technology

The technology was mounted on a white acrylic sheet. Openings for the screen, keyboard, and submission button were laser cut out of the acrylic. The opening for the keyboard revealed only the main keys (all letters, the space bar, and the backspace key), leaving out all markup and control keys. On the screen, only the text entered via the keyboard was displayed in large black letters on a white background. Submitted messages were printed on

the output panel, and saved in a log file on a USB stick. An acrylic box at the back of the input panel stored all Raspberry Pi components, wires, the USB stick, and the power bank.

During the initial meeting with the council, several members of the council were concerned about the open nature of the input device, and expressed that they were worried that people would type inappropriate words, which would then be publicly displayed. They suggested that the input should be manually moderated, allowing only approved messages to be printed. As such an approach could potentially lead to subjective moderation, and would take up a significant amount of time, the researcher counteracted this argument by explaining the importance of immediate feedback, as demonstrated during the Scribbles, Magnets, Typewriter study. Instead, it was agreed that a list of swearwords would be used to automatically censor inappropriate words before printing, by replacing them with asterisks. A publicly available list of 458 ‘bad words’<sup>5</sup> was used to filter the printed content. The original uncensored message was stored in the log file.

#### 9.2.4 Choice of input technology locations



**Figure 9.5:** Map depicting the selected input locations and Ashburton Park

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<sup>5</sup><https://code.google.com/archive/p/badwordslist/downloads>



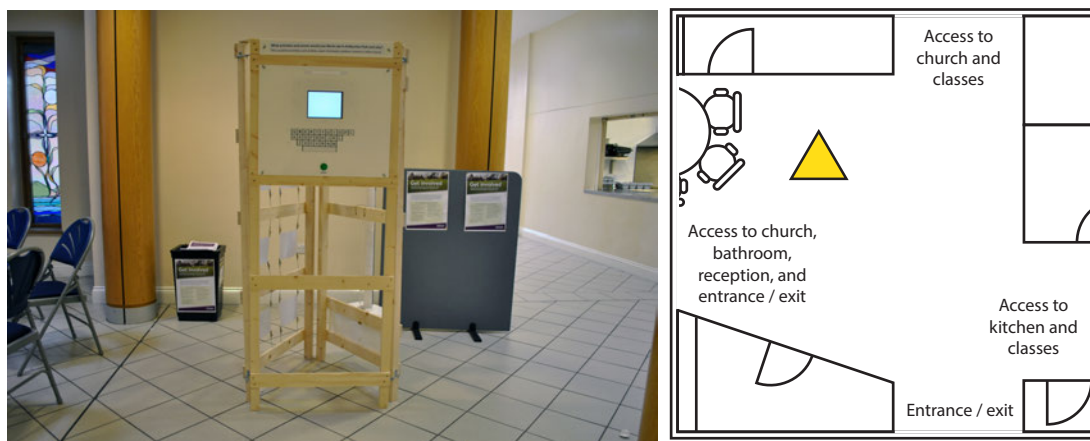
The researcher proposed to the council that the device should be situated at a variety of locations throughout the consultation period, to reach a diversity of people. This decision was based on the findings from the Visualising Mill Road study, where distribution throughout a community encouraged participation from a wide range of people. The council agreed with this approach, especially because reaching certain demographics proved difficult in their previous engagements. The employee leading the Ashburton Park consultation described the council's key challenge with consultations as follows: *"The problem for us is that reaching the same people is very easy, you use someplace with a lot of activity and ask people there [what they think]. And trying to overcome that, and finding out how to do that. So we knew we were working with yourself, and that we could try and reach more people [...] try to cover as many different people as possible."*

In the end, the council selected three venues that they believe act as 'community hubs' in the Addiscombe / Woodside area: a church, a primary school, and a library, all within walking distance of Ashburton Park (see Figure 9.5). The school was specifically chosen to reach out to parents and children: *"We knew we wanted to involve a school, to get more parents and children involved in giving us feedback. That [demographic] tends to be the group that doesn't come to the church or those kind of locations, they're busy, it really has to be an urgent issue for them to come. It is hard enough to get people to vote sometimes, let alone let them give their opinion on something like this. [...] And there's high footfall at a school. And a wide age range, children, parents, carers, teachers."* The church was involved based on previous positive experiences: *"The Communications team suggested St Mildred's. They had done stuff there before, and said it was a really great place: lots of different people, great venue with some space. So, [our approach was] partly not trying to get into the same old places, broadening it, but keeping good places, like the church."* The final location, the library, was selected because of its appeal to a variety of people: *"Another central place is the library, they have all these classes and activities, and because of that a diversity of people, so it seemed like an obvious choice."* The council approached all three venues and agreed upon deployment dates.

While the locations were chosen by the council, the specific placement of the Typewriter inside the venues was determined by the researcher. This placement was informed by findings from the previous case studies. At all three locations, the Typewriter was deployed along walkways, and in locations that locals routinely visit. This decision was based on the findings from the Visualising Mill Road and Scribbles, Magnets, Typewriter studies, which revealed that situating input technology in popular locations, that are part of the commu-

nity's existing practices, was key to people noticing the installations. Unlike the VoxBox deployment, where the parallel and perpendicular placement of the device in relation to the walkway affected engagement with the back of the installation, the Typewriter's triangular design allowed all sides to be visible independent of the positioning. The rotation of the Typewriter was kept identical at all three locations, with the input panel facing the walkway. Furthermore, while the Typewriter was located was deployed in central, popular zones in each venue, it was deliberately not placed in close proximity to areas that are continuously occupied (e.g. reception). The findings from the Scribbles, Magnets, Typewriter study revealed that a lack of privacy and anonymity during the submission process acted a barrier to participation. For the Typewriter deployment, therefore, areas were chosen that enabled people to wait for quiet moment, during which they could submit their messages in private.

### 9.2.4.1 The church



**Figure 9.6:** The church setting: the Urban Typewriter is located in the main hallway, which has doorways to counselling rooms, class rooms, the reception, the kitchen, the church, and the two exits.

St Mildred's is an Anglican (Church of England) church built in 1932. In 2007 an extension was added to the church, named St Mildred's Centre. The purpose of this Centre is described as follows: *"It enables us to reach out and support those who are most vulnerable in our neighbourhood to help build up family life by providing groups for all ages, and to offer facilities for private parties and special events."* At St Mildred's Centre, rooms of different sizes are available for booking. These rooms are used for numerous purposes such as counselling, yoga, dance classes, toddler music classes, church activities, a coffee club for the elderly, and support for homeless people.

These classes and clubs are generally not religious, and attract many people who do not attend the church itself. The Centre is open on weekdays and Saturdays from 08:30 until 22:00.

For this study, the Centre proposed placing the installation in the concourse, the Centre's main hallway which contains a reception and entrances to all rooms, the kitchen, the bathrooms, the church, and two entrances / exits. In the hallway, seating is available for those waiting for counselling or classes, and for activities such as the weekly coffee club and monthly lunches.

#### 9.2.4.2 The school



**Figure 9.7:** The school setting: the Urban Typewriter is located in the foyer, used by staff members, parents, and children to sign in and out, or to speak to administration staff

Woodside Primary School is a Community School for both girls and boys, and was opened in 2012 after the merge of a local infant and junior school. The school is attended by 934 pupils between the ages of 3 and 11. It was selected by the council as it is located in close proximity to Ashburton Park (see Figure 9.5). The school is open on all weekdays from 07:30 until 16:00. In the early morning, a breakfast club is hosted for pupils, and from 09:00 onwards the school day starts.

For this study, the school proposed placing the installation in the main foyer. The reception for visitors and administration questions is based in this foyer, as well as a touch screen used by pupils, staff, and visitors to 'check in' and 'check out' upon entering and leaving the school. Within the school, this foyer is the only area visited by all people on a daily basis.



**Figure 9.8:** The library setting: the Urban Typewriter is located at the centre of the library, next to the newspaper area

### 9.2.4.3 The library

Ashburton Library is a public library located near Ashburton Park. Until 2006, the library was located in the main building in the park itself, until it was moved to bigger, more modern premises nearby. The library facilitates activities and events for a variety of age groups, including weekly toddler classes, monthly seminars on local history, and a daily homework help club. In addition, the library offers study space, a newspaper area, and access to computers, CDs, DVDs, and books.

For this study, the staff members proposed placing the installation in the library's open space. Although this open space contains a seating area, and is situated near the library's books for adults, it is not the most frequently visited zone. The main walkway, which runs along the other end of the library, is far more popular. However, as this walkway is narrow, and needs to facilitate groups of people, wheelchairs and pushchairs, deployment in this walkway would have affected the accessibility of the library. Therefore, the open space was selected as the second best location within the venue, where the Typewriter would stand out and be noticed, while providing enough space for people to interact with the installation.

### 9.2.5 Data output design

The second panel (anti-clockwise) served as the data output panel. Here, all submitted messages were printed onto a receipt by a thermal printer. The idea was that such a log of contributions could serve two functions, by acting as feedback (i.e. your contribution has been recorded), and providing insight into the participation of others (i.e. how many mes-

sages are there, what have others said?). In the Scribbles, Magnets, Typewriter study, such a display proved particularly popular, engaging people to read the collected messages. The receipt was guided into a see-through 1.5 meter tall acrylic tube. In this tube, approximately 50 submitted messages were displayed at a time, with the most recent ones at the top. At the bottom of the tube a white laser cut acrylic box collected the remainder of the receipt. Use was made of a tube to prevent people from being able to tear off the receipt, which occasionally happened during the Scribbles, Magnets, Typewriter study.

### 9.2.6 Visualisation design

The third and final panel served as the visualisation panel. Here, summaries of the most frequently mentioned themes were displayed, allowing people to see what suggestions others had made over time. These summaries were printed on A5 sheets, and attached to crocodile clips. In total, 7 summaries were shown in a random order, containing the theme name (e.g. 'Sports') and corresponding icon (e.g. image of a football), the percentage of messages till date addressing that theme (e.g. '15%'), and one to five example submission messages (e.g. *For example: "climbing wall", "football", "cycling track"*). An example of a summary is shown in Figure 9.9. All icons were sourced from the Noun Project<sup>6</sup>. Use was made of icons to provide insight into the key data at a glance, simply by looking at the presented imagery. Furthermore, as children were expected to be present at all three locations, the use of simple icons was deemed most appropriate for all age groups. Colourful backdrops were chosen to contrast with the white colour scheme of the Typewriter, with the intention of making the visualisations stand out.

On the visualisation panel an information sheet about the project was also displayed. On this sheet, information was provided on the purpose of the installation, the council's aim, the research aim, and contact information.

## 9.3 In-the-wild study design

The Urban Typewriter was deployed for one week at each location, between 29 February and 19 March 2016. Originally, the study was meant to be for a 4-week duration. However, this had to be shortened due to *purdah*, a period before elections or referendums during

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<sup>6</sup><http://thenounproject.com/>, specifically: Restaurant by Andreas Larsen, Swimming Pool by Aaron K. Kim, Swings by Rafael Farias Leão, Film by Nicolas Ramallo, Theater by Diego Naive, Soccer Ball by Laurent Patatin, and Music by Edward Boatman



**Figure 9.9:** Summaries on the visualisation panel

which councils and other authorities should “*not publish any material which, in whole or in part, appears to be designed to affect public support for a political party*”, as governed by Section 2 of the Local Government Act 1986<sup>7</sup>, and amended in 1988<sup>8</sup>. During this period it is recommended that councils “*should not produce publicity on matters which are politically controversial*”, where publicity is defined as “*any communication, in whatever form, addressed to the public at large or to a section of the public.*”<sup>9</sup> As the Ashburton Park plans have played, and continue to play, an important role in the local elections, Croydon Council had to shorten the deployment to 3 weeks in order to finish the consultation in line with purdah for the 2016 Greater London Assembly and London Mayoral elections.

During the deployment, the researcher conducted observations at all three locations. Depending on the opening times of each participating venue, the interactions people had with the device were studied for either 5 or 6 days per location. The researcher started up the Urban Typewriter early in the morning, at a time agreed upon with staff members, who could provide insight on when people would start coming in. Generally, this was between 08:00 and 09:00. During this time, the researcher would verify whether there was enough paper in the thermal printer, and on alternating days replace the visualisations with summaries of the latest data. In addition, all data was manually retrieved from the USB stick every morn-

<sup>7</sup>[www.legislation.gov.uk/ukpga/1986/10/section/2](http://www.legislation.gov.uk/ukpga/1986/10/section/2), accessed February 2016

<sup>8</sup>[www.legislation.gov.uk/ukpga/1988/9/section/27](http://www.legislation.gov.uk/ukpga/1988/9/section/27), accessed February 2016

<sup>9</sup>[www.local.gov.uk/documents/10180/6869714/L15-91+Unpacking+Purdah\\_04.pdf/c80978b9-dc0b-4eee-9f81-49bd47afeb2d](http://www.local.gov.uk/documents/10180/6869714/L15-91+Unpacking+Purdah_04.pdf/c80978b9-dc0b-4eee-9f81-49bd47afeb2d), accessed February 2016

ing. Once completed, the installation was booted up and remained on until the battery ran out of power, approximately 18 hours later.

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Church	4.5	6.5	5.5	6.5	6.5	4.0	—
School	6.0	4.0	4.0	5.0	3.0	—	—
Library	5.0	6.5	—	7.0	5.5	6.5	—

**Table 9.1:** Hours of observations per day, with dashes indicating the venue was closed

Once the installation was running, the researcher would find a place to sit somewhere near the installation, to allow for detailed observations of people interacting with the device. All three venues had either chairs or a sofa in the area around the Typewriter. In total, the researcher conducted 86 hours of observations (see Table 9.1).

The following data was collected using a mixed methods approach: (i) logged messages from the Typewriter; (ii) observations in situ, logged in detail by the researcher several hours a day; (iii) semi-structured interviews were conducted with staff members and local residents at the three venues; (iv) in addition, data from the paper and online survey were shared by Croydon Council to enable a comparison of the three feedback collection methods. Stacks of paper surveys were distributed at the three participating venues. A plastic box, with an opening at the top, was placed at each location for people to return their filled out surveys. The online survey was promoted through the council’s website, Facebook page, and Twitter account.

## 9.4 Findings

During the three week deployment, 171 interaction sessions were observed – defined as moments during which one or more people interacted with the Urban Typewriter. The main findings from the deployment are described below.

### 9.4.1 Curiosity

From the observations, four distinct types of discovery were identified that motivated people to approach the Urban Typewriter: organic discovery, the honeypot effect, championing, and publicity.





**Figure 9.10:** The three panels of the Urban Typewriter: input, visualisation, and output

#### 9.4.1.1 Discovery and noticing

The observations revealed that the majority of people noticed the appearance of the Urban Typewriter, especially when they were highly familiar with the environment. For example, in the school a sofa in the foyer was moved to make space for the Typewriter, which the majority staff members, parents, and children immediately noticed upon entering the school (e.g. young boy to mother: “*Why did they move the couch? [looks at Typewriter] What is that?*” [P94]).

Furthermore, due to the placement of the Typewriter in the school’s foyer and the church’s main corridor, all people entering and leaving these buildings walked past the installation. In the library the installation was placed in a more spacious zone away from the main walkway, resulting in far less passing traffic, and as a result fewer people approached the Typewriter by stumbling upon it.

#### 9.4.1.2 Honey-pot effect

The presence of people at the Urban Typewriter often intrigued others, leading to them approaching the Typewriter too – a phenomenon known as the honey-pot effect. At the church, 10.7% of the observed sessions induced the honey-pot effect, compared to 20.8% at the school, and 13.2% at the library.





**Figure 9.11:** Honeypot effect at the school: children and parents join others at the installation and look over their shoulder

When someone was typing a message on the Typewriter, others were often observed looking on from a distance, or looking directly over their shoulder – either silently or by getting involved (e.g. “*Fantastic idea, I like that idea!*” [P152]). The distinct clicking sound produced by the large keyboard played an important role in this, as this unfamiliar sound was observed catching the attention of passers-by.

Once the first person was finished typing and had moved on, the person or people who had been observing them then approached the Typewriter to interact with it themselves. This behaviour of looking on allowed people to learn more about the purpose of the installation, and how to operate it, simply by watching others.

#### 9.4.1.3 Championing

Throughout the deployment prominent members of the community actively also increased awareness of the Urban Typewriter and encouraged people to participate, for example by shepherding people to the installation. This championing behaviour was on their own initiative, and was not suggested or encouraged by either the researcher or the council. At the church, 14.3% of the observed sessions were initiated by a champion. In comparison, at the school championing did not occur at all (0%), and at the library 31.6% was initiated by a champion.

Observations showed that staff members of the church’s community centre regularly approached people they saw in the hallway, to let them know about the Typewriter. Reflecting on this, the manager explained: ‘*Oh yeah, we have encouraged them. We’ve said “You must go and have a think about the question, and then come back [and participate].”*’ [C1]. Similarly, the organiser of a weekly coffee club in the church attempted to convince people to partici-

pate at several occasions. During the coffee club she told all attendees about the installation (*"You can tick out what you want."* [C2]) and its purpose. As some attendees were older and less mobile, the organiser asked them what they would like to contribute and then submitted messages on their behalf (see Section 9.4.6.2). Furthermore, the organiser of a monthly lunch held in the church's hallway played a similar role in involving people. Before and after the lunch she actively encouraged attendees to take part, exemplified in the following exchange:

Organiser [C3]: *"Have you seen this?"*

[organiser points at Typewriter]

Organiser: *"You can type a message about Ashburton Park and it even prints it. There is an online survey as well, but you should do this!"*

Female [P41]: *"I will, yeah."*

[Female walks towards Typewriter]

During the lunch she also approached all 7 tables and asked the ~25 attendees, many of whom she knew personally, if they would like to contribute a message to the installation. Whenever anyone would provide her with a suggestion, she would walk to the Typewriter and submit it on their behalf. For example:

Organiser [C3]: *"What else should I type for you, Kat? What else did you say?"*

Kat [P46]: *"Children's entertainment."*

[organiser types and submits message]

Kat: *"And tables with chessboards on."*

[organiser types and submits another message]

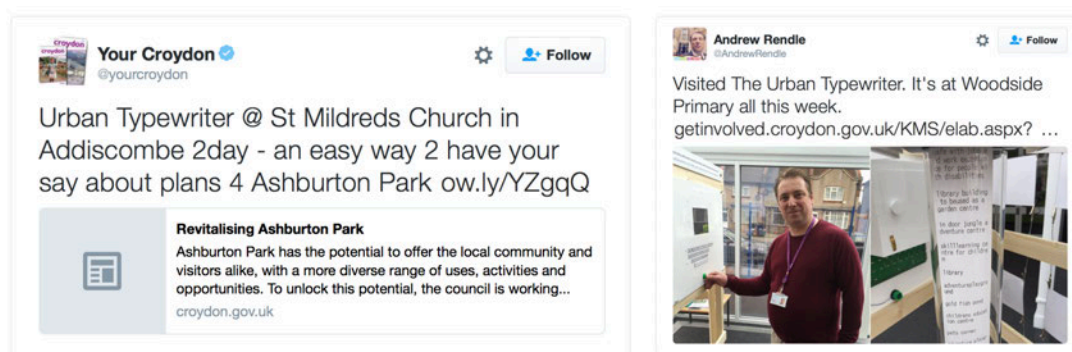
At the primary school the staff behind the reception did not actively encourage people to participate, in person. However, they did send an e-mail to the parents of all children attending the school, to inform them about the installation. While none of the sessions at the school were initiated by a champion, other staff members were observed taking up a champion-like role when they would pass by the Typewriter. For example, at the end of a school day, when approximately 10 children congregated around the installation, a teacher joined them and

explained to them that they should answer the question posed on the input panel. Following her explanation, the children grouped around the input panel and submitted their answers one by one.

At the library, staff members took up the most active role in championing, regularly referring customers at the information desk to the Typewriter (e.g. “Steve, have you seen the survey we have going on?” [L1], “Don’t forget to do your survey.” [L2]). After a seminar in the library, one of the staff members took it upon herself to guide the people exiting the room to the Typewriter, mentioning to her colleague “I’ll direct them there.” [L3].

#### 9.4.1.4 Publicity and social media

People also approached the Urban Typewriter after finding out about the installation through traditional media (local newspaper, council’s leaflets and posters) and online media (council’s website, local blogs, Twitter, Facebook). From the observations and interviews it emerged that few people had come across the notices in the traditional media. At the library, a staff member noted, “There was already someone here in the morning, asking for it. They read about it in the [local newspaper]. Word got around!” [L3]. Another woman, who had seen the notice in the newspaper, thought not many would have noticed it: “I don’t think they did a good job advertising it, it was a very small section.” [P231].



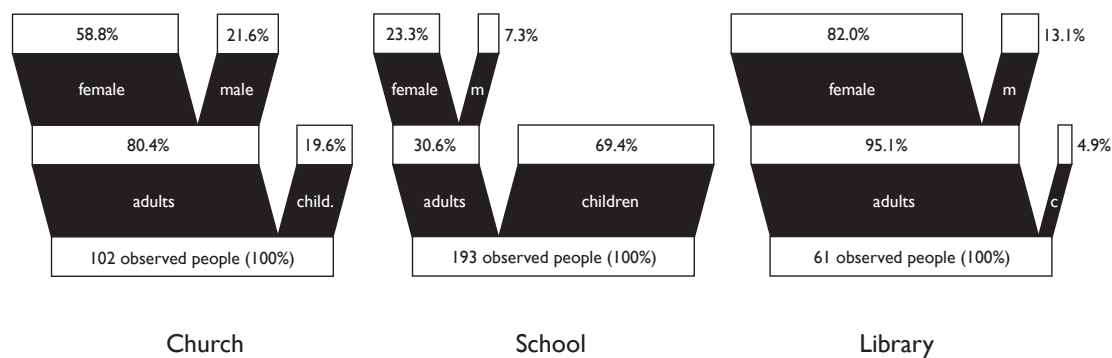
**Figure 9.12:** Left: One of the council’s tweets about the Typewriter. Right: Tweet by a local councillor about the installation, including photos of his visit.

The online publicity was successful at raising awareness of the survey on Ashburton Park, in particular through social media. Through Facebook and Twitter, the council, individual councillors, community groups, news outlets, and local residents were observed sharing the

survey URL and information on the deployment of the Typewriter (see Figure 9.12). An overview of all publicity during the deployment can be found in Appendix C.2.

#### 9.4.1.5 Reaching the wider community

The demographics of the people observed interacting with the Typewriter differed per location: while the majority of people at the church and library were adults (80.4% and 95.1% respectively), at the school most were children (69.4%). At all locations, most adults observed interacting with the device were female (see Figure 9.13). However, this difference in participation between women and men was less noticeable during weekends compared to weekdays. For example, while men made up 19.7% of the observed interacting adults in the church during weekdays, they made up 47.6% on the Saturday. Similarly, while men made up 10.9% of the observed interacting adults in the library during weekdays, they made up 27.3% on the Saturday.



**Figure 9.13:** Demographics of observed people at the three locations

Observations during the deployment showed that the church primarily attracted three groups of people. Firstly, parents (approx. 28-40 years old, mostly mothers) with young children (approx. 0-4 years old), who were there to attend classes. Secondly, children (approx. 5-11 years old) attending the after-school clubs. Thirdly, retired people (both men and women, approx. 65-85 years old), who were attending coffee mornings, lunches, classes, and religious events. At the primary school, there were also primarily three groups of people: staff members (approx. 25-50 years old), children (5-11 years old), and parents (approx. 28-45 years old). At the library, the final location, there were two distinct groups of people: visitors of the library (i.e. there to look at information facilities provided by the library, all ages) and secondary school students who made use of the library to do their homework (approx. 11-16 years old).

During the deployment, several people mentioned the selection of locations. For example, a man and woman were observed talking about the school location:

Male [P81]: *“I wonder why they put it here.”*

Female [P82]: *“They will put it all over Addiscombe, surely.”*

The manager of the church’s community centre believed the three locations would attract very similar people: *“If you think about the vicinity of Ashburton Park... obviously, you are getting the demographic of people who are out and about... The school, again, will be a very similar group, as would the library. So, perhaps you wouldn’t reach... I think a supermarket would be a good idea [...] everybody has to go buy food.”* [C1]. The chair of the park’s community group raised this too, and mentioned that they had previously suggested including a supermarket when talking to the council: *“We were asked about having the questionnaire installation being set up in the different locations. Once again it depends on if people have time to go there to answer the questionnaire, and also who actually goes to those locations? One of our thoughts was to set it up in the local [supermarket], because a lot of people pop in and out there. But the council has its own way of doing things.”* [F1].

#### 9.4.2 Observations

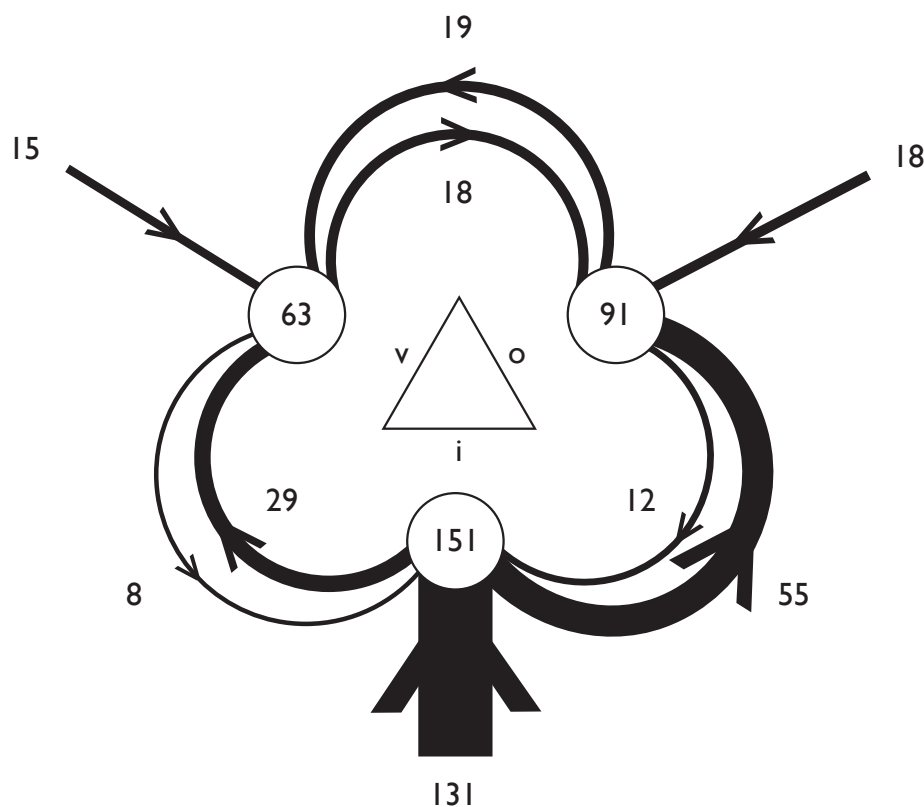
In total, 171 interaction sessions were observed – defined as moments where one or more people interacted with the Urban Typewriter either directly (e.g. submitting a message) or indirectly (e.g. talking about the installation from a distance). These sessions involved 356 people, many of whom interacted in groups. The average size of these groups was 2.08 ( $\sigma = 1.71$ ) (see Table 9.2). Groups were largest at school, where the largest groups consisted of 8 to 12 children. At the library, 65.8% of interactions were by solitary people, compared to 46.4% at the church, and 40.3% at the school.

Location	Observed sessions	Observed people	Average group size	Standard deviation
Church	56	102	1.82	1.10
School	77	193	2.51	2.18
Library	38	61	1.61	1.08
Total	171	356	2.08	1.71

**Table 9.2:** Overview of observed interaction sessions and average group sizes

During the majority of the interaction sessions (131 out of 171, i.e. 76.6%), people approached the Urban Typewriter from the front to view or interact with the input panel. Far fewer sessions started at the output panel (8.8%) or visualisation panel (10.5%). A further 7 sessions (4.1%) with the Typewriter took place from a distance, not relating to a specific panel but to the overall installation.

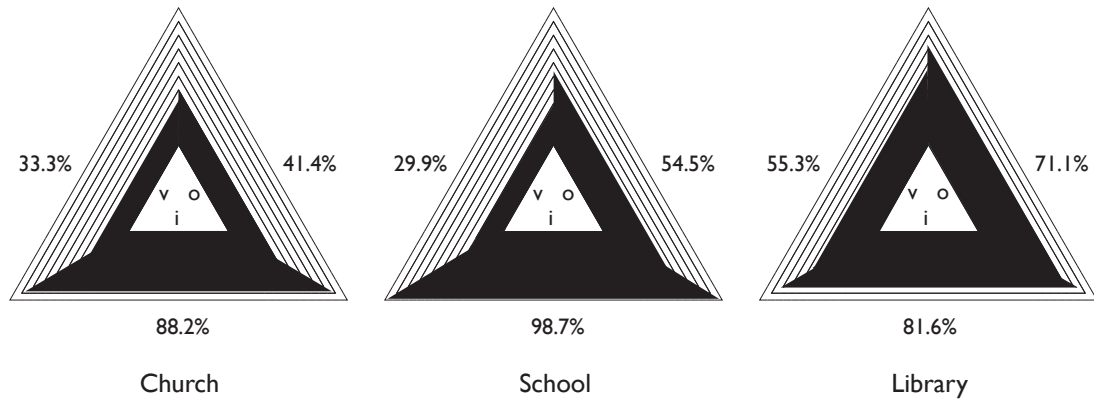
In 65 instances (38%), the sessions involved only the viewing of and / or interaction with one panel. This was generally the input panel (54 out of 65 sessions, 83.7%). In the remaining 100 sessions, people viewed and / or interacted with either two panels (30.4%), or all three panels (28.1%). An overview of the approaches and movements during the observed sessions is presented in Figure 9.14.



**Figure 9.14:** Visualisation of the observed sessions, and how people approached the Typewriter and proceeded to walk around it (i = input side, o = output side, v = visualisation side)

Movement around the Urban Typewriter differed greatly per location. For example, at the school the visualisation panel was viewed during only 29.9% of the sessions compared to

55.3% at the library (see Figure 9.15). Similarly, while the output side was viewed in only 41.4% of the sessions in the church, it was viewed in 71.1% of the sessions in the library.



**Figure 9.15:** Percentage of the observed sessions that took place at the three panels at the different locations (i = input side, o = output side, v = visualisation side)

### 9.4.3 Explorations

Upon approaching the Urban Typewriter, many people talked about the installation and its purpose — primarily by asking the other people in their company “*What is this?*” or “*What are you doing?*” Some made guesses at what it was (e.g. “*What do you reckon it is? A computer?*” [P60]) or used it as an opportunity to invite others to explore the Typewriter with them, for example:

Male [P91]: “*What’s that for?*”

Female [P92]: “*I don’t know, shall we read it?*”

[Both walk towards the Typewriter’s input panel.]

While some people had heard of the Ashburton Park survey before (e.g. “*Oh, is this the online survey?*” [P35], “*Is that the Ashburton Park survey?*” [P20], “*Ooh, what is that? Oh, that is the online questionnaire, ha!*” [P10]), the majority of people were unaware of the survey (e.g. “*This is the first I have heard about it.*” [C3], “*Oh, consultation. It looks interesting.*” [P88]).

Once people approached the Urban Typewriter, the exploration of the three different panels started. As shown in Figure 9.14, after viewing the input panel, many people discovered the output panel. In the sessions with groups of people, one person typically took the lead and explored the panels first, and then communicated their discoveries to the others (e.g. “*Look,*

*it says here what people said.*" [P121], *"Oh, look, it's there, mum!"* [P170], *"Does it print it out? Oh, look, it has all the little bits."* [P241], *"Look, it comes out here."* [P78], *"It is like a receipt machine, that is so cool."* [P137]). Similarly, the exploration of the visualisation panel was often initiated by one individual, for example:

[Female 1 [P133] walks to visualisation panel.]

Female 2 [P134]: *"What are you reading there?"*

[Female 2 joins Female at visualisation panel.]

[Female points at visualisation.]

Female 1: *"3%? I thought it would be more like 30%."*

[Female 1 and Female 2 view all visualisations.]

After exploring the various panels, people often returned to the input panel to submit one or more messages.

#### 9.4.4 Viewings

In the 171 observed interaction sessions, 91 involved the viewing of the output panel, and a further 63 involved the viewing of the visualisation panel. During the observations it became apparent that there were two main motivations for people to look at the output panel: to read the messages submitted by others, or to see their own messages. The first – and by far the most popular – motivation was to see what others had suggested. For example, at the school a man and a woman looked at the output and visualisation panels together:

Female [P82]: *"You can't say they don't have any ideas on there."*

[Male [P81] nods.]

Female: *"Everyone says 'a better playground', they're right."*

[Female and Male continue to read messages and visualisations.]

People who walked to the output panel to read previous contributions generally read all visible messages, either alone or in small groups. The latter would often involve one person taking the lead and reading the messages out loud, especially if the group consisted of an adult with one or more children (e.g. young girl walks to output panel, reads top message,



tells mum “*Oh look, it’s there, mum!*” [P170]), after which mum joined and read out loud all messages on the output panel).

A staff member from the church explained that she regularly returned to the output panel to read the latest submissions: “*What do we have today? [...] I’m just compelled to find out what everyone has written. [...] It’s great, people have some really great ideas, things I would have never thought of.*” [C1]. Staff members at the school and the library were observed reading the latest messages regularly too. At the library, where several staff members actively monitored interactions at the Typewriter, they were also observed reading messages directly after a session. For example, after three teenage girls had just finished submitting a series of messages, two staff members read their contributions:

Staff 1 [L1]: “*Let’s see if they said anything sensible.*”

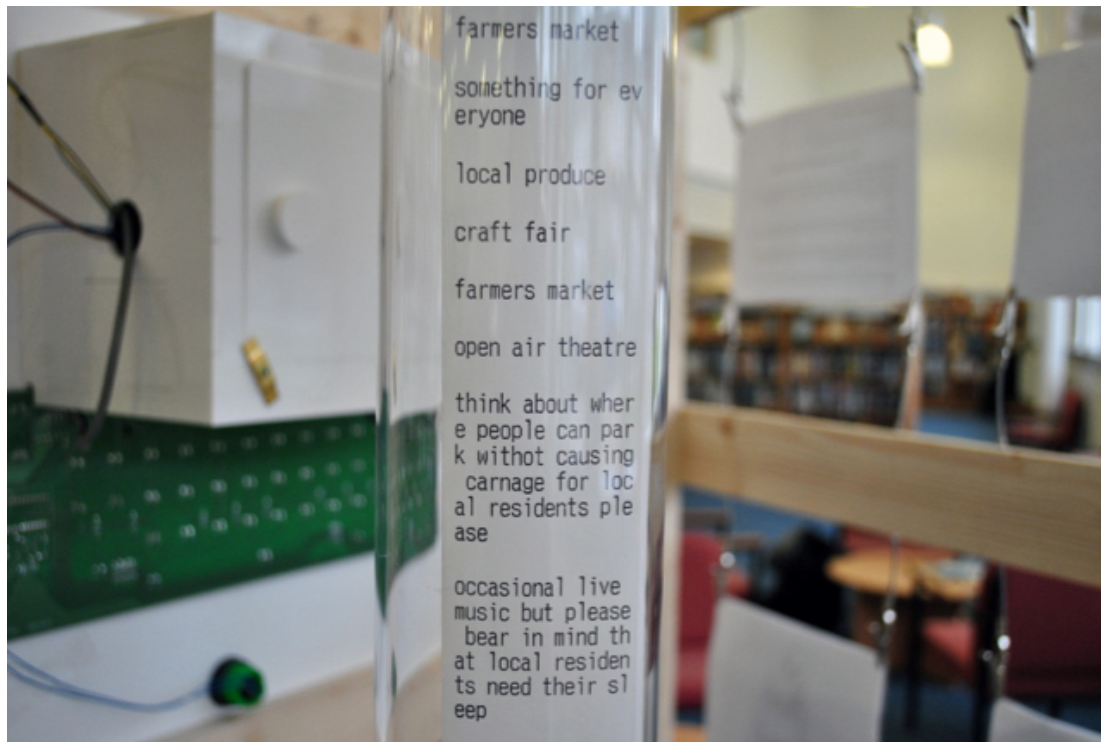
[Staff members read messages.]

Staff 2 [L2]: “*I think they are quite sensible.*”

[Staff members return to their desk.]

The observations revealed that not everyone agreed on the ideas for Ashburton Park, as several people disagreed out loud while reading the submitted messages (e.g. “*A cafe? we have plenty on the high street already, we don’t need that.*” [P61], “*Swimming? No way!*” [P109], “*You can’t put a cinema in the park!*” [P201]). Others, however, were observed using both the messages on the output panel and the visualisations as a source of inspiration for their own submissions (e.g. “*A swimming pool would be great, we don’t have one around here – I am going to put that down too.*” [P68]). For example, two women [P257, P258] were observed sitting down near the Typewriter, noticing the visualisations, and reading them out loud. They then walked to the input, submitted a message, and walked back to the visualisations. One of the women pointed at one of the visualisations, said “yes”, and walked to the input panel to submit another message. After walking back and forth several times, they discovered the output panel, and started using this as a source of inspiration. Altogether, they spent 13 minutes walking between the different panels and submitting a total of 38 messages.

The second motivation for people to look at messages was to see their own submissions appear. This behaviour was particularly popular amongst children. For example, one young girl guided her grandfather to the output panel to show him her message (“*This is what I said,*



**Figure 9.16:** Submitted messages were displayed in a tube on the output panel

*this is what mummy said*" [P78]). Another boy [P190] was observed typing and submitting a random sequence of letters, walking to the output panel, clapping his hands with joy at seeing his message being printed, and returning to the input repeat this process several times more.

Finally, the sound produced by the pressing of the keys enabled local champions to monitor activity without having to be near the installation. In the quietest location, the library, the sound was especially noticeable, and the staff members mentioned that they could hear the buttons being pressed from where they were located, so they would know if someone was taking part. During the study, these staff members were observed reading the latest messages on three occasions, often shortly after they were submitted and the contributors had left.

#### 9.4.5 Discourse

The Typewriter was observed to evoke two types of discourse. Firstly, it encouraged people to talk about Ashburton Park, and the concerns and ideas they have for the park. Secondly, the installation evoked scepticism about the role of the council in the past, the council's decision to conduct a consultation, and the extent to which people believed their comments would be taken into account in the decision making process.

#### 9.4.5.1 Importance of topic

As the topic the Urban Typewriter addressed was determined by the council, it was unclear beforehand whether this topic was a pressing issue for the local community as well, and how their perceived importance of the topic would affect participation. Throughout the study, however, people were observed discussing the park and its buildings (e.g. *“It is just such a shame to see the pavilion in such a bad state.”* [P233]). More specifically, many made it clear that they would like to see action being undertaken in the park in the near future (e.g. *“They need to do more in that park.”* [P117], *“I just want them to do something with the building.”* [P9], *“They should use the library building.”* [P60], *“I really think they should be using the buildings.”* [P44]). The Chair of the park’s community group described local’s interest in the future of the park as follows: *“I don’t think people have a huge amount of faith [in the council], but there is an awful lot of enthusiasm.”* [F1].

During 46.4% of the observed sessions at the church the people discussed the posed question about Ashburton Park with either the people they came with or bystanders. At the primary school such discussion happened only during 23.4% of the observed sessions, compared to 31.6% of the sessions at the library. The nature of the discussions varied: while some discussed their ideas for Ashburton Park, others discussed why they would not contribute (e.g. *“I don’t really go to Ashburton Park”* [P198] followed by a discussion on ‘better’ parks in the area). Similarly, while some discussed their personal wishes for the park (e.g. *“I want a theme park.”* [P184], *“A cafe would be good. I’ll have a cappuccino there.”* [P58]), others spoke more from a community-oriented perspective, discussing what they believed would be of use to the wider community. For example, some brought up how certain events could improve the social relationships in the area (e.g. *“You need things like country shows to bring people together.”* [P227]), while others discussed how businesses in the park could help the need for employment in the area (e.g. *“Well, I’d suggest a McDonalds [...] They do a lot of things and they are very community-minded. You need to work with cooperations because they have the money, you know. They provide jobs, which we need [around here].”* [P1]). Furthermore, some brought up practical issues related to happenings in the park, such as health and safety (*“They would have to have a lifeguard there for health and safety.”* [P134]), and costs for the local area (*“I don’t want a circus. The price of it is too high, the grass will become muddy and then no one can use the park. And it costs the council so much money to repair that again. It should be a communal use.”* [P43]). For

others, the question evoked memories of what Ashburton Park used to be like (e.g. “*When I was young, there was a little paddling pool!*” [P171], “*When it used to be a library, there was a constant flow of people and activity in the park.*” [P81]).

#### 9.4.5.2 Scepticism

During the deployment it became apparent that a number of people were sceptical about the council’s consultation on Ashburton Park, in particular amongst key community figures who had worked with the council in the past. Some people did not believe the council would take the suggestions into consideration. For example, during one of the interviews a local resident asked the researcher the following:

Male [P58]: “*So, all these ideas, do you pass them on to the council?*”

Researcher: “*Yes.*”

Male: “*I don’t think they will take any notice*”

[Male mimics putting his index fingers in his ears while saying “*la la la la*”.]

Male: “*You know the old council building? We said we wanted apartment buildings, and they tore it down. I hope they don’t tear the buildings in the park down.*”

A staff member at one of the participating venues conveyed a similar scepticism, based on previous experiences with the council:

*‘I think that the ideas that are on there are great, they are free from any budgetary constraints or any of the other considerations that perhaps Croydon Council might have. I think that is a really worthwhile exercise, because it’s really... a lateral thought, isn’t it. But I don’t know that Croydon Council actually will pay attention to it, because there is lots of other local issues (sic) they haven’t [paid attention to]. I feel a sort of irony, here, with this wonderful “Oh, we’re going to ask you all what you think, we will listen”, because we have quite recently had “We are going to ask you all what you think and we will listen – but actually we are not going to do anything like that.”’ [C1]*

A blogpost on a local news site conveyed a similar sentiment, questioning the purpose of the consultation:

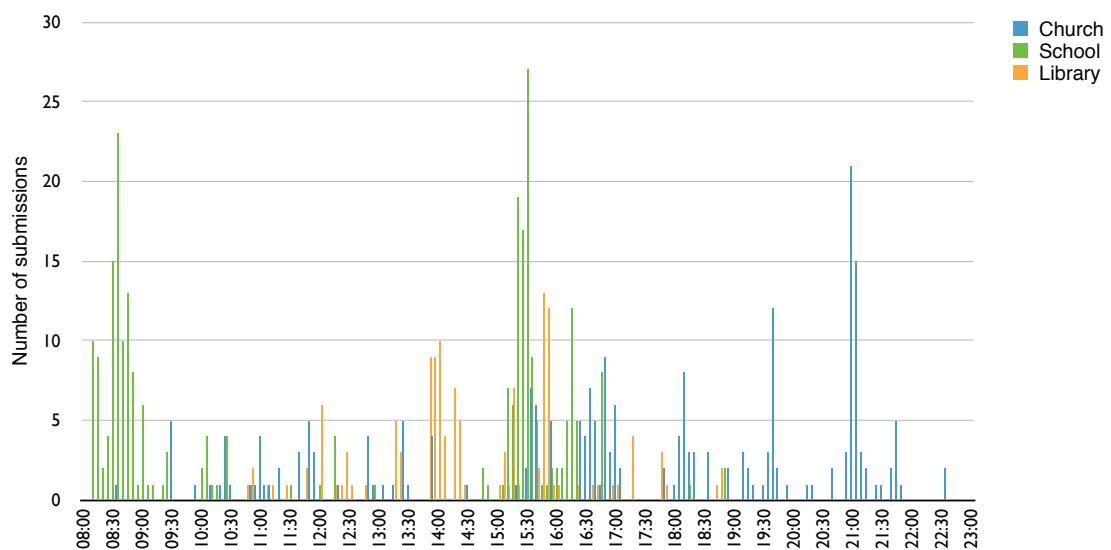
*“And yes, it is yet another consultation. [...] These things are generally done by council officials merely to tick a few boxes, fulfil statutory requirements, and will then be used to justify whatever it was that the council had decided it wanted to do in the first place.”*

Others did believe the council would take the feedback into consideration, but were worried about the pace at which the council would act on the feedback. For example:

*“I imagine they collect the data and I imagine that they would share it with us. How they act on the data, and how quickly, really, is unknown. I have found things to be very slow. It is all very well getting people’s feedback, but if you are very slow in getting back on that feedback, the local people will start to think: they are no different than any other administration, why ask us for our feedback at all? People end up getting a bit deflated.” [F1]*

#### 9.4.6 Interactions

During the deployment a total of 1502 messages were submitted, of which 669 were identified as relevant contributions (see Section 9.4.7). The number of submissions differed per location, with 228 submissions in the church, 309 in the school, and 132 in the library.



**Figure 9.17:** Aggregate submission times of the relevant messages, showing varying peak submission times for the three locations

The submission times of contributions varied per location, as shown in Figure 9.17. At the church, messages were submitted throughout the day, peaking after school hours – when the after-school clubs took place – and in the evening hours, when the church’s community

centre hosted different adult classes. At the school, there were bursts of activity just before the start of the school day (from 08:00 until 09:00) and just after the end of the school day (from 15:00 until 16:30). During the school day, relatively few submissions were made. At the library, contributions were more evenly spread throughout the day, peaking in the afternoon between 14:00 and 16:00.

Timespan between submissions	All sub- missions	Relevant submis- sions	Irrelevant submis- sions
$\leq$ one minute	81.2%	72.9%	87.5%
Between one and five minutes	8.0%	11.0%	5.8%
Between five and ten minutes	1.7%	2.6%	1.1%
Between ten and fifteen minutes	1.3%	2.1%	0.7%
Between fifteen and thirty minutes	2.3%	3.7%	1.2%
Between thirty minutes and one hour	1.7%	2.9%	0.8%
> one hour	3.7%	4.8%	2.8%

**Table 9.3:** Timespan between submissions for all messages, the relevant messages, and the irrelevant messages

Many people were observed submitting multiple messages (e.g. “*I can’t resist to give my input.*” [P81]). This behaviour can also be seen in the log data: the majority of messages are submitted within a minute or less from the previous submission (see Table 9.3). However, not all messages submitted in short succession were necessarily from the same author, as a fast input pace was also observed during group sessions, or when people queued, for example because of the honeypot effect. Similarly, the timespan of over one minute between submissions is not necessarily indicative of distinct authors, as some typed slowly, or returned to the input panel occasionally to add additional messages. Only during two observed sessions did people question whether multiple submission were allowed or ethical: 1) a woman at the church concluded aloud, in the presence of several other people, “*So, I shouldn’t come in [and submit messages] every day, then I will sway the results.*” [P39], 2) a mother at the school told her son that he was not allowed to submit more, to which he responded “*Only one? Where does it say that?*” [P93].

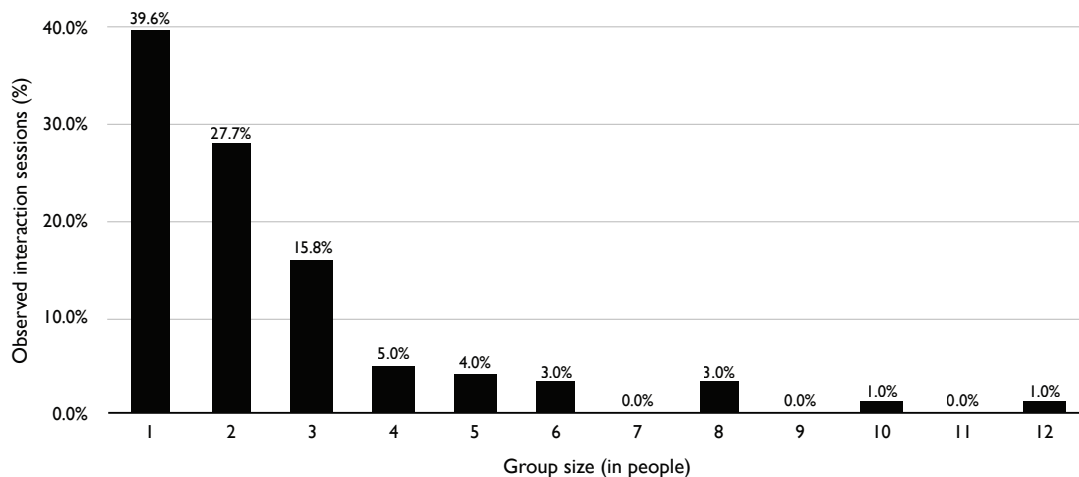
During the observations or interviews, no concerns emerged about privacy or inappropriate content. The manager of the church’s community centre, however, did bring up that the deployment was likely relatively trouble free due to the type of question the Typewriter addressed:

*“It is unmonitored, it gives the impression of being unmonitored. So people are quite free to put whatever they like. And because it is quite a fun question, people have given really nice responses. I think if you would put an issue on there that is perhaps a bit more conscientious, which has the potential to affect people’s lives in a negative way, you may need to put even more filter on the language you get back.” [C1]*

The observations and messages revealed that during the submission process some people were submitting with an awareness that someone from the council would be reading the messages. For example, one woman told the person submitting on her behalf: *“Add ‘thank you’ – if someone goes through this we should thank them.”* [P1]. In addition to two submissions containing such ‘thank yous’, eight messages included the word ‘please’ (e.g. *“cafe and toilets please”*), and one started with a greeting (*“hi i would like to see a funfair in the summer.”*).

#### 9.4.6.1 Collaboration

Of the 171 interactions sessions that were observed during the study, 101 involved the submission of one or more messages (59.1%). The majority of these submission sessions (60.4%) involved group interactions, where two or more people were interacting with the Typewriter. Groups ranged from 2 to 12 people, as shown in Figure 9.18. In 39.6% of the observed submission sessions, only one person was present.



**Figure 9.18:** Group sizes of observed sessions during which submissions took place

During group interactions, people often collaborated during the submissions process by dividing tasks. For example, collaborating parents and children completed different elements

of the interaction, as exemplified in the following interaction where the mother types while the toddler presses the submit button:

Female [P3]: *"Shall we do this?"* [to toddler]

[Female types message.]

Female: *"Right, press that massive green button."*

[Toddler submits, Female types another message.]

Female: *"Green one, green one, good."*

[Toddler submits, Female types another message.]

Female: *"Green one again, great!"*

[Toddler submits.]

The spelling of words often acted as either conversation starters for adults or learning moments for children. For example, one staff member asked someone sitting near the Typewriter for advice on the spelling of the word 'lido', resulting in a brief conversation and championing moment:

[Staff member [C1] types message.]

Staff: *"Lido, L - I - D - O?"*

Female [P7]: *"Yes. That is a great idea, actually."*

Staff: *"Yeah, I think that would be nice. There is one in Purley and the children just love it."*

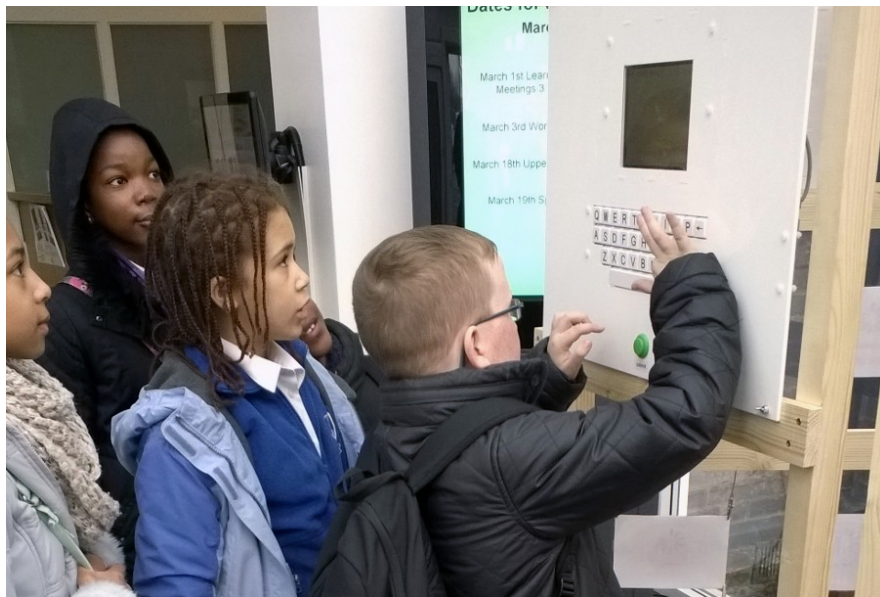
Female: *"Yeah, it would be marvellous."*

Staff: *"You should have a go too!"*

Female: *"I will, I will, I just had a look at it, and I will definitely write something before I leave."*

Parents and teachers were also observed correcting their children (e.g. *"That's not how you write that!"* [P171] in response to her daughter writing 'notice bored' instead of 'notice board', *"But how you spell that?"* [P106]) or helping them (e.g. father [P111] slowly spelling out *"e-q-u-i-p-m-e-n-t"* to son; boy [P79] spelling out *"t-h-e-a-t-r-e"* to friend).





**Figure 9.19:** Children entering messages in turns

As the Urban Typewriter only enabled one person to type at a time, groups were observed submitting messages in turns. While some coordinated this verbally (e.g. “*The next one is my one.*” [P211], “*Now I want to write something, let me write something!*” [P250], “*You go now.*” [P274]), most arranged the turn-taking quietly by simply queueing.

#### 9.4.6.2 Submitting on behalf of others

On several occasions, people were observed submitting messages on behalf of others. For example, during the weekly coffee club the organiser asked the other attendees, many of whom were over 75 years old and had difficulty walking, for suggestions:

Female [C2]: “*Do you want a cinema?*”

Male [P26]: “*Yeah, that might be good.*”

[Female types and submits message.]

Female: “*Live music?*”

Male: “*Yes!*”

Female: “*Pop? And Jazz.*”

Male: “*Yeah.*”

[Female types and submits message.]

Female: *“That’s two from us.”*

[Female sits down.]

Similarly, several parents typed on behalf of their children. For example, when one young boy [P172] started interacting with the Typewriter, his mother interrupted him (*“Don’t do that!”*), asked him what he wanted to submit, and typed his message for him.

Several community champions also acted as mediators, for example by approaching people at tables having lunch (*“bandstand, maybe”* [P45]), asking them for suggestions, and moving between the installation and the tables to submit all ideas. Emergent champions were observed submitting on behalf of others too. For example, a teenage boy who had just learnt how to use the Typewriter by observing others acted as a champion when two other boys joined him at the installation. He explained that suggestions could be entered via the Typewriter, and that all ideas were printed on the side (exclaiming *“Look, look, look!”* when his submission was being printed [P214]). Following this explanation he asked the boys, *“So, what do you want?”* and typed and submitted their suggestions for them while the boys looked on. This behaviour was also observed among adults, typically when someone joined another person at the installation who had already submitted messages. For example:

[Female 2 joins Female 1 at Typewriter.]

Female 1 [P241]: *“What would you like? I put summer fete, outdoor cinema... Would you like some live music?”*

Female 2 [P243]: *“Yeah!”*

[Female 1 submits message on behalf of Female 2.]

### 9.4.6.3 Accessibility

During the deployment it became clear that the installation was not highly accessible to everyone. While people of all ages managed to submit messages, it became apparent that a proportion of people between 70 and 80 years old, especially women, were hesitant to use the Urban Typewriter, instead preferring the paper version of the survey (e.g. *“I’m not very computer-y, I will take the paper survey.”* [P42], *“Oh, I can’t work these things, I will do the paper survey.”* [P231]). The manager of the church’s community centre explained that some of these people had approached staff members: *‘A lot of people, especially from the church, come*

down to the office and ask us about it. Asking what it is. It is as if they are scared to do it, thinking they may need to pay money or something, so they kind of need our approval, for us to say “It’s okay, go do it.” [C1]. Several people, however, overcame this by approaching people in the vicinity of the device, and asking them to submit a message on their behalf (e.g. *Could you write it? I’m not very good with these things.* [P1], *“I’m not good with computers, could you type it?”* [P233], see Section 9.4.6.2).

While the interface was self-explanatory for the vast majority of people, on one occasion someone was observed asking staff for help with the installation:

[Male types message and turns to staff member.]

Male [P264]: *“Sorry, but do you press the green button when you are finished?”*

Staff [L2]: *“Yeah, and then it prints it to the side.”*

Male: *“Fantastic.”*

[Male submits message and walks to output panel.]

Male: *“Oh yeah, that’s mine there.”*

[Male looks at visualisations, and leaves.]

Finally, several small children had trouble reaching the keyboard (e.g. *“I am not sure if I can reach if I am honest.”* [P140]). To combat this problem, one parent [P155] was observed lifting up her young son, asking him *“What do you want to type?”* and holding him at the height of the Typewriter’s keyboard until he finished typing and submitting his contribution.

#### 9.4.7 Contributions

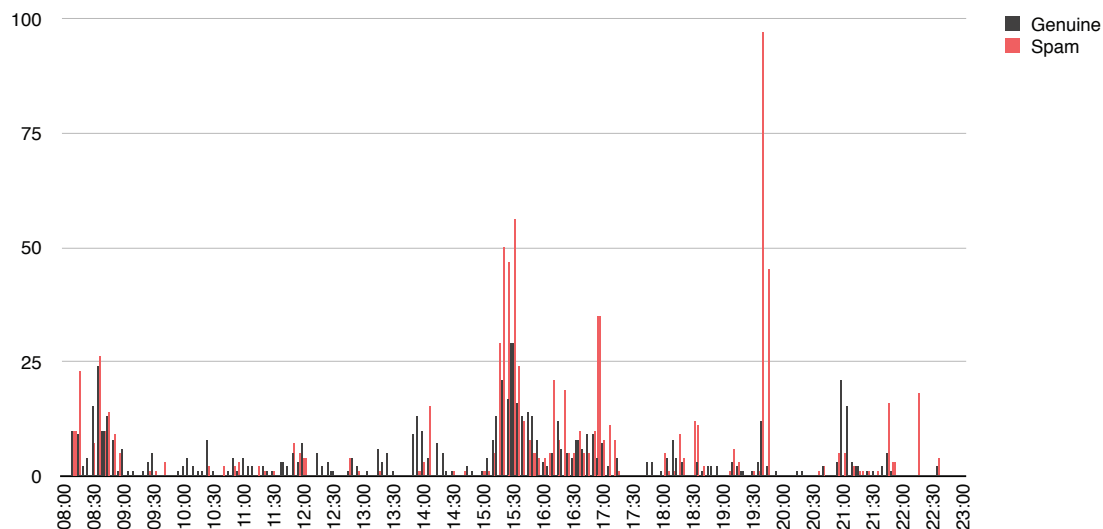
A total of 1502 messages were submitted via the Urban Typewriter. From these message, 669 (44.5%) were identified as relevant contributions. The 833 irrelevant messages (55.5%) were discarded for a variety of reasons, as detailed in Table 9.4. A sample of 100 messages was coded by two judges to determine inter-rater agreement, with the aim of establishing whether the identification of irrelevant messages was conducted correctly. Each message was coded as either ‘relevant’ or ‘irrelevant’ to the question posed. This resulted in a Cohen’s Kappa coefficient of 1, showing perfect agreement (Viera et al., 2005).

Both the observations and log data showed that irrelevant messages were submitted throughout the day, often interspersed with relevant contributions. For example, during a 10

Reason to discard	Example	Messages	Percentage
Nonsensical	e.g. “j b hgvbh c vb u vb”	359	43.1%
Empty	e.g. “ ”	248	29.8%
Unrelated: random	e.g. “hi”	119	14.3%
Unrelated: name	e.g. “rosie rosie”	69	8.3%
Unrelated: pop culture	e.g. Adele lyrics	25	3.0%
Unrelated: naughty	e.g. “poo”	10	1.2%
Unrelated: social media	e.g. “follow [username] on instagram”	3	0.4%

**Table 9.4:** Overview of the 833 discarded messages

minute period at 19:39 in the church (see the peak in Figure 9.20) 158 messages were submitted with only seconds between submissions. Of these messages, 144 were identified as irrelevant (e.g. “weeeeeee”), interspersed with 16 relevant contributions (e.g. “out door cinema showings every saturday”).



**Figure 9.20:** Aggregate submission times of both relevant and irrelevant messages

The observations also revealed that children were the main submitters of irrelevant messages, especially groups of children. At the school, several such interaction sessions with groups of children were observed, typically starting out with relevant submissions (e.g. “They should open the ice cream place back up.”) and shifting to more irrelevant messages as the children spurred each other on. They, for example, appropriated the device to spread rumours, or to greet their friends. Eventually, one of the children would stop the submission of such messages by warning the group about the potential consequences (e.g. “We are going to get in

*big trouble.*” [P142], “*Oh my gosh, guys, that is bad.*” [P143] in response to “[name] is stupid.” and “[name] is a poo head.”), after which the group would leave.

Location	Messages	Relevant messages	Percentage relevant	Average length	Avg. suggestions per message
Church	607	228	37.6%	26.3 ( $\sigma = 34.7$ )	1.14 ( $\sigma = 0.64$ )
School	701	309	44.1%	19.3 ( $\sigma = 18.3$ )	1.06 ( $\sigma = 0.45$ )
Library	194	132	68.0%	49.7 ( $\sigma = 82.2$ )	1.14 ( $\sigma = 0.59$ )
All	1502	669	44.5%	27.7 ( $\sigma = 44.9$ )	1.11 ( $\sigma = 0.55$ )

**Table 9.5:** Overview of messages per location

The 669 relevant contributions had an average length of 27.7 characters ( $\sigma = 44.9$ ), with the longest message consisting of 723 characters. On average, these messages contained 1.11 ( $\sigma = 0.55$ ) suggestions for the park per message (see Table 9.5). While most messages only contained one suggestion, some contained a list of suggestions (e.g. “*music international food festival outdoor cinema historic reenactment restore paddling pond local music and local beer festival craft fair*”). A thematic analysis was conducted on all messages. Again, inter-rater agreement was determined on a sample of 100 messages, using the list of themes that emerged from the thematic analysis, to establish whether the assignment of themes was done correctly. The ratings from two judges revealed a Cohen’s Kappa coefficient of 0.84, showing almost perfect agreement (Viera et al., 2005).

The most popular themes throughout the deployment included sports, cultural events (outdoor cinemas and music in particular), food and drink, and opportunities for play. A full overview of all themes is shown in Table 9.6. Both the observations and messages revealed that there were slight differences in the type of content submitted at the different locations. For example, many of the messages at the school were submitted by children, who were particularly keen on sports facilities. Similarly, people at the library – who were primarily adults – provided relatively many suggestions related to cultural events.

#### 9.4.7.1 Messages compared to traditional consultation methods

During the deployment, the council also promoted their paper and online versions of the survey. In total, they received 379 responses to the online survey, and 18 to the paper survey. While these versions of the survey contained a wider range of questions relating to Ashbur-

Theme	Church	School	Library	Total	% of all themes
<b>Cultural</b>	<b>62</b>	<b>67</b>	<b>48</b>	<b>177</b>	<b>24.3%</b>
Art	7	5	4	16	
Circus	2	1	0	3	
Church activities	3	0	0	3	
Festival	4	3	2	13	
Library	0	3	0	3	
Museum	0	0	4	4	
Music	20	7	10	37	
Theatre	7	6	5	18	
Outdoor cinema	14	27	15	56	
Village fete / Fair	5	15	8	28	
<b>Community centre</b>	<b>2</b>	<b>0</b>	<b>2</b>	<b>4</b>	<b>0.6%</b>
<b>Dog facilities</b>	<b>4</b>	<b>0</b>	<b>0</b>	<b>4</b>	<b>0.6%</b>
<b>Food and drink</b>	<b>37</b>	<b>32</b>	<b>25</b>	<b>94</b>	<b>12.9%</b>
Cafe / Coffee shop	18	7	11	36	
Ice cream	3	4	1	8	
Farmers market	3	0	5	8	
Food festival	3	0	0	3	
Restaurant	5	3	0	8	
Other	5	18	8	31	
<b>Nature</b>	<b>8</b>	<b>4</b>	<b>1</b>	<b>13</b>	<b>1.8%</b>
<b>Play</b>	<b>41</b>	<b>54</b>	<b>9</b>	<b>104</b>	<b>14.3%</b>
Games	4	3	0	7	
Ice rink	3	1	0	4	
Lido / Splash pad	17	20	4	41	
Playground	17	30	5	52	
<b>Sports</b>	<b>55</b>	<b>97</b>	<b>29</b>	<b>181</b>	<b>24.9%</b>
Climbing wall	2	4	0	6	
Fitness	0	0	8	8	
Football	11	32	3	46	
Basketball	2	8	1	11	
Gym	2	2	1	5	
Martial arts	3	0	0	3	
Rugby	2	9	0	11	
Running	5	3	4	12	
Table tennis	2	0	1	3	
Tennis	5	6	2	13	
Other	21	33	9	63	
<b>Toilets</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>9</b>	<b>1.2%</b>
<b>Zoo</b>	<b>2</b>	<b>1</b>	<b>0</b>	<b>3</b>	<b>0.4%</b>
<b>Other</b>	<b>48</b>	<b>60</b>	<b>34</b>	<b>137</b>	<b>18.9%</b>
Distinct themes (excl. 'Other')	31	25	22	34	

**Table 9.6:** Themes in the messages, including messages that addressed multiple themes

ton Park, two questions specifically addressed the topic addressed by the Urban Typewriter: what activities and events people would like to see in the park.

### Online survey

The first question, a multiple choice question, asked people: “*What other activities / events would you like to see in the park?*”. An overview of the responses to this question can be seen in Table 9.7. A total of 111 people did not answer this question. The remaining 268 respondents selected an average of 4.2 events per person. The most frequently selected event was a farmers market (80.2%), followed by an outdoor cinema (70.5%), and festivals and live music (66.4%). In addition, 26 people added suggestions by selecting ‘Other’. On average, these people made 1.6 suggestions. The most requested events and activities included car boot sales (23.1%), outdoor gym equipment (7.7%), carnival (7.7%), and craft fairs (7.7%).

Choice	Votes (online)	Percentage	Votes (paper)	Percentage
Farmers markets	215	80.2%	15	83.3%
Outdoor cinema	189	70.5%	11	61.1%
Festivals and live music	178	66.4%	11	61.1%
Performing arts	167	62.3%	11	61.1%
Fetes	152	56.7%	14	77.8%
Sporting events	111	41.4%	10	55.6%
Circus and funfairs	87	32.5%	6	33.3%
Other	26	9.7%	4	22.2%
Total	1125	-	82	-

**Table 9.7:** Responses to online questionnaire

The second question, an open-ended question, asked people to clarify their answer: “*Please explain the reason for your choice for [the previous question] and add any further comments in the space below (maximum 2000 characters).*” Of the 379 responses to this question, 253 were identified as relevant contributions. A total of 111 messages were empty, and 15 contained content that did not contain an explanation or suggestion (e.g. “.”, “hj”). On average, relevant messages consisted of 117.4 characters ( $\sigma = 103.6$ ).

The relevant messages typically contained an explanation. For example: “*A farmer’s market would be a brilliant addition to the area. The ones in Herne Hill and Crystal Palace seem to be thriving.*”. While many people expressed being in favour of all suggested events and activities (e.g. “*All activities would help bring communities together*”, “*Anything to bring all kinds of people to the park and to engage the whole community*”), some used the opportunity to also explain their concerns (e.g.

*“I would want to see a balance between activities above and quiet”, “I am however skeptical of circus and funfairs because of the damage such events does to the ground”, “it could be intrusive to local residents”).* Although some explained that their choices were directly motivated by their own needs and wishes (e.g. *“These are things that’d interest me”, “These are the sort of events I would attend.”*), others appeared to have considered the wider community in their answer (e.g. *“The above choices will offer a range of activities that will meet the needs of the local communities, from the young to the old and it’s quite diverse.”*, *“It would also encourage local independent traders, helping the local economy”).* Overall, the provided answers were detailed and often consisted of one or more full sentences that justified people’s choices.

### **Paper survey**

The paper survey received a total of 18 responses. For the multiple choice question, popular answers largely corresponded to those provided via the online survey (see Table 9.7). Again, the farmers market (83.3%), outdoor cinema (61.1%), festivals (61.1%), and performing arts (61.1%) were popular choices. Fetes were more popular in the paper survey (77.8%) compared to the online survey (56.7%). On average, people selected 4.5 events. In addition, 4 people added suggestions by answering the ‘Other’ field. On average, these people made 1.5 suggestions, including car boot sales (33.3%), dog shows (33.3%), community fetes (16.7%), and a skatepark (16.7%).

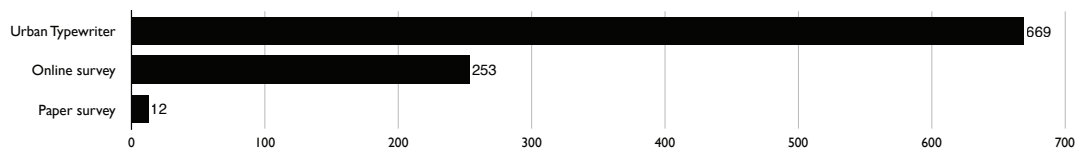
The second, open-ended question received 12 (66.7%) relevant contributions. The 6 (33.3%) discarded messages were removed because they did not contain an explanation or suggestion (e.g. *“No comment”*). Relevant messages were, on average, 115.7 characters ( $\sigma = 68.9$ ) long. Again, people commented on personal wishes (e.g. *“Love to see lots of events. Would visit regularly.”*), ideas for the wider community (e.g. *“Fetes/boot sales/family days attract wide cross section of the community”*), and concerns (e.g. *“The only point for discussion is how often the events are because we wouldn’t want the grass to be chewed up?”*).

### **Comparing contributions**

The three feedback methods, namely the Typewriter, online survey, and paper survey, received highly different levels of response (see Figure 9.21). The Typewriter elicited the most relevant contributions (669), followed by the online survey (253), and paper survey (12). It should, however, be noted that the observations of the Typewriter revealed that many people submitted multiple messages in sequence. Whether this behaviour also occurred online

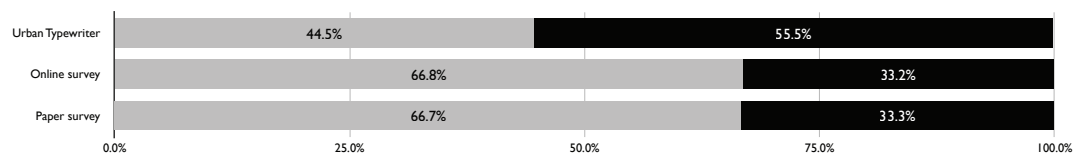


and on paper is not known. However, while neither of these mediums had any restrictions preventing such repeat submissions, the effort of filling out multiple online or paper surveys was significantly higher, due to the number of questions they contained, than adding a message via the Typewriter.



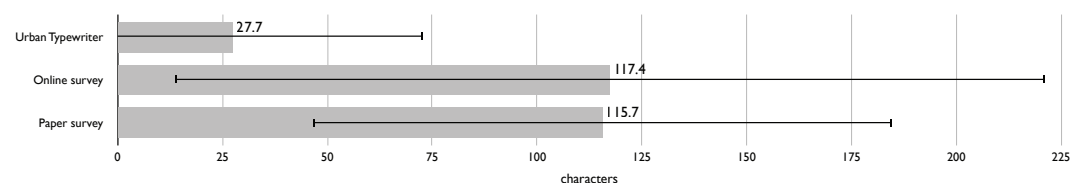
**Figure 9.21:** Number of messages per medium

While a large number of suggestions were submitted via the Typewriter, this medium also received the largest percentage of irrelevant messages (55.5%, as shown in Figure 9.22). Both the online and paper survey received a lower proportion of such ‘spam’ (respectively 33.2% and 33.3%).



**Figure 9.22:** Number of relevant contributions per medium (relevant contributions in grey, irrelevant in black)

The average length of the relevant contributions also differed per medium, as shown in Figure 9.23. The online survey received the longest relevant messages ( $\mu = 117.4$ ,  $\sigma = 103.6$ ), followed by the paper survey ( $\mu = 115.7$ ,  $\sigma = 68.9$ ) and the Typewriter ( $\mu = 27.7$ ,  $\sigma = 44.9$ ). Due to the large deviation in message length, no significant differences were found between the three feedback methods.



**Figure 9.23:** Message length (in number of characters) per medium

There were also noticeable differences in the topics that were addressed by people via the three feedback methods. For example, the ‘farmers market’ option was the most popular suggestion selected in both the online and paper survey, with over 80% of people choosing

this option. In comparison, via the Typewriter, which did not provide pre-selected suggestions, the farmers market was only suggested 8 times, in just over 1% of the messages. Similar differences can be seen for the majority of topics (see Tables 9.6 and 9.7). As both the online and paper surveys received highly similar results, it appears likely that the answering options (i.e. completely open-ended or multiple choice with the option of adding additional suggestions) strongly affected the popularity of themes. After the deployment, a council staff member in charge of the consultation reflected on the Typewriter as follows:

*‘The Urban Typewriter is a very valuable survey tool which has enabled us to reach out to audiences who might not have otherwise gotten involved/responded to the survey. This is demonstrated for example by how people responded to the question “What activities and events would you like to see in the park”? [via the traditional consultation methods vs. via the Urban Typewriter], which I think shows the difference between what younger and older audiences would prefer to see and this is something for us to really think about and consider how we can address this in the future.’*

#### 9.4.8 Revisitation

The observations revealed that there were two reasons for people to return to the Urban Typewriter after their first interaction with it. Some returned to read the latest submissions (e.g. “Let’s see what we got yesterday.” [C1]), and others returned to submit messages. The latter either did not submit in the first instance (“I was here on Tuesday, so I read it then, and I went home and had a thought about it but I haven’t done it yet. I’ll do it once I have a spare moment.” [P35], “I’ll have a think about it.” [C2]) or to add additional ideas (e.g. “I did one on the first day, and then I think I came back a few days later with something else.” [C1]). In addition to some needing time to think about what to submit, some people interacting in groups were also observed returning alone at a later stage to submit their input. Revisitations were observed throughout the deployment, at all deployment locations.

### 9.5 Discussion

The objective of this case study was to examine engagement with a situated consultation installation. More specifically, the aim was to investigate what types of engagement the collection and display of qualitative data could evoke in a neighbourhood setting. The case study’s research questions are discussed below, followed by a description of the types of

engagement the installation evoked and the role of design and contextual factors on this engagement.

**UT RQ1: How does asking a community for suggestions (i.e. consulting) affect engagement?**

The Urban Typewriter deployment was focused on one topic, namely the activities and events people would like to see in the local park, and why. This topic was determined by the council, as part of their consultation on the future of the park. The topic was aimed at local residents, who were assumed to have pre-existing knowledge about the park in question (e.g. where it is, what activities and events would be feasible, etc.). The question successfully engaged locals into thinking about their wishes for the park, and those of the wider community. As the selected locations did not attract people who were unfamiliar with the area, the topic proved appropriate and the question was understood by people from different ages and backgrounds. However, while the question was aimed at not only finding out *what* people would like, but also *why* they would like it, this aspect was not often addressed in the messages submitted via the Typewriter. The phrasing of the question likely played a large role in this, as it attempted to ask two questions in one, while the online and paper question addressed them separately and in turn received justifications for almost all answers.

The topic addressed by the Typewriter, which had been a prominent issue in the area for years, proved highly relevant to the local community – and as a result sparked discourse on a range of topics, such as people’s personal perceptions, ideas for the community, the history of the park, and the actions taken by council up until now. The open-ended nature of the question also enabled unrestricted answers, providing people with the opportunity to submit highly diverse ideas. The consultation was focused on collecting suggestions, rather than only feedback on existing plans. Analysis of the content of the submitted messages revealed that they addressed a range of issues beyond the ideas provided by the council. These findings suggest that the open-ended consultation approach was successful in enabling the community to have their say and communicate their ideas and concerns.

A further benefit of the focus on one consultation question emerged during the deployment: as the question did not change over time, it was possible for people to return at a later stage to engage with the device again. Similarly, it allowed people the time to make others aware of the council’s consultation and the Typewriter.

**UT RQ2: How does the use of textual input technology affect engagement and contribution quality?**

For the Urban Typewriter a large keyboard was used as input mechanism, which was connected to a screen displaying the typed letters. This method was chosen as it simultaneously provided familiarity, as most people have used keyboards before, and novelty, as the type of keyboard and positioning of the keyboard on a situated device were highly unusual. The deployment revealed that the vast majority of people successfully interacted with the input technology, and were able to write and submit their suggestions. However, it also emerged that the technology was not accessible to all people, as some immediately associated it with using a computer – something they knew they were unfamiliar or uncomfortable with – and therefore concluded that they would also not be able to use the Typewriter. Thus, while the familiarity of the input technology enabled most people to easily interact with the installation, it simultaneously deterred engagement for a small number of people, mainly elderly people. As a result, however, some opted to ask others to submit on their behalf. Similar collaborative sessions were also observed during many group interactions, where the panel set-up enabled people to convene around the installation.

The unrestrictive nature of the input technology enabled the submission of all kinds of messages. The council was concerned that this would result in the submission and display of inappropriate messages, such as messages containing swear words. Therefore, a list of inappropriate words was used to censor certain words. However, the findings from the deployment showed that such messages were submitted only very rarely. Nevertheless, the deployment of installations for qualitative feedback does raise questions about the need for moderation and the level of moderation. The immediate display of messages on the data output panel proved highly engaging and encouraged people to enter messages. If, however, the Typewriter had made use of higher level of moderation, as initially suggested by the council, for example by requiring manual reviewing and monitoring of all messages (Churchill et al., 2003), this instant feedback would not have been possible which would likely have negatively affected engagement with the installation.

**UT RQ3: How does the immediate display of qualitative contributions affect engagement?**

The printed log of the latest submissions proved particularly successful in encouraging people to read and discuss others' opinions. Furthermore, the direct feedback provided by the printer upon submitting a message acted both as a confirmation of the receiving of the data and as a motivation for people to submit additional messages in order to see their suggestions appear on the log. Amongst kids, in particular, this also led to the submission of irrelevant messages, as some were more intrigued by the interaction with the printer than they were concerned about the submitted content.

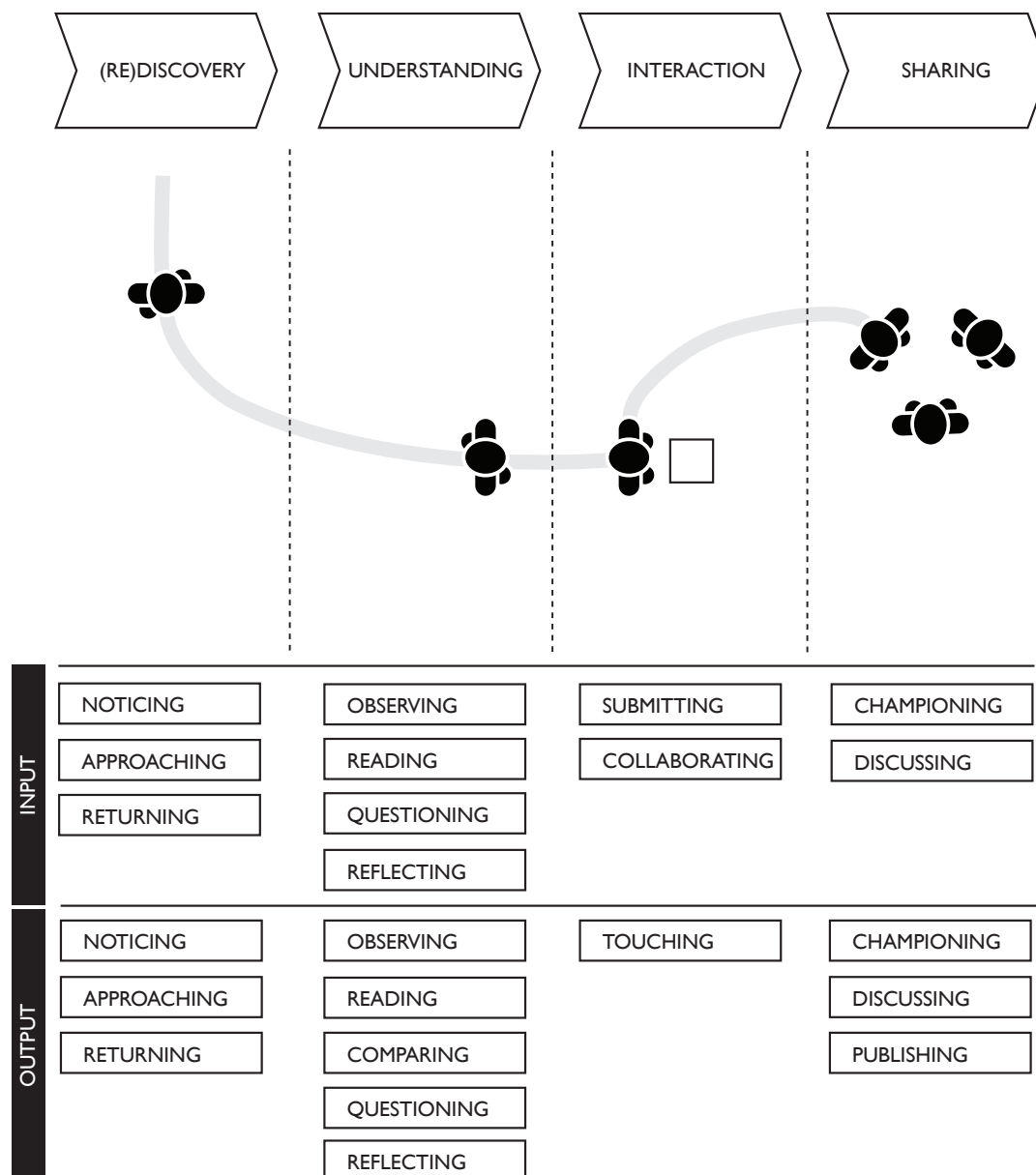
As the log was displayed in a see-through acrylic tube, it enabled groups to gather around the log and read the messages simultaneously. Such group sessions often resulted in discourse on related topics, including conversations about the messages left by others. Furthermore, the public display of submissions enabled people to monitor the consultation, by returning at a later stage to see what else had been suggested. In addition, the messages acted as inspiration, as people were observed walking between the output and input to submit additional suggestions, read more, and so forth.

#### **UT RQ4: How do delayed visualisation updates affect engagement?**

The visualisations displayed on the third panel of the Typewriter were visited least frequently in comparison to the other two panels. However, those who did visit the panels often spent time reading all visualisations, and those who visited the installation in groups often discussed results that stood out to them. Moreover, the visualisations provided people with an understanding of the key topics that were addressed over the duration of the deployment, as opposed to the receipt which only gave insight into the latest submissions. As a result, the visualisations provoked discourse on the key themes that emerged from the consultation.

Furthermore, some people also used the visualisations as inspiration for ideas, and walked to the input panel shortly after viewing the visualisation in order to enter their suggestions – similar to how the data output was used. However, people were rarely observed returning to the visualisations at a later stage. The lack of interactivity or a clear rhythms of updates likely affected this. As the visualisations did not update in real-time, and there was no clear indications of when they would be updated, there was no anticipation about the latest visualisations.

### 9.5.1 Types of engagement



**Figure 9.24:** Types of engagement with the input technology and output visualisations

The deployment of the Urban Typewriter evoked a variety of engagement behaviours, ranging from noticing to active championing, as shown in Figure 9.24.

In the discovery stage, people **noticed** the device. This was found to be particularly common in settings that people were highly familiar with, where the introduction of the novel installation was observed immediately. Often, people then immediately **approached** the Typewriter to find out more about it, either at the input, output, or visualisation side. Fur-

thermore, people were observed **returning** to the installation, either to submit additional comments or to read the latest submissions.

In the understanding stage, people **observed** how others interacted with the installation, by watching them submit messages or read the displayed submissions and visualisations. In addition, people **read** the displayed information themselves, to understand the purpose of the installation and how they could take part. Furthermore, people were observed actively **comparing** the visualisations and comparing submitted messages. When multiple people were present in the area around the Typewriter, people were observed **questioning** others about the installation, and what information they had submitted or what they were reading. During this stage, people were also observed **reflecting** on the history of the park and the history of the council's involvement in running the park.

In the interaction stage, people **submitted** messages via the input panel. Regularly, people **collaborated** while interacting, helping each other with the spelling of words or the process of entering text. People were not observed touching the visualisations or textual output, or directly interacting with the installation in any other way.

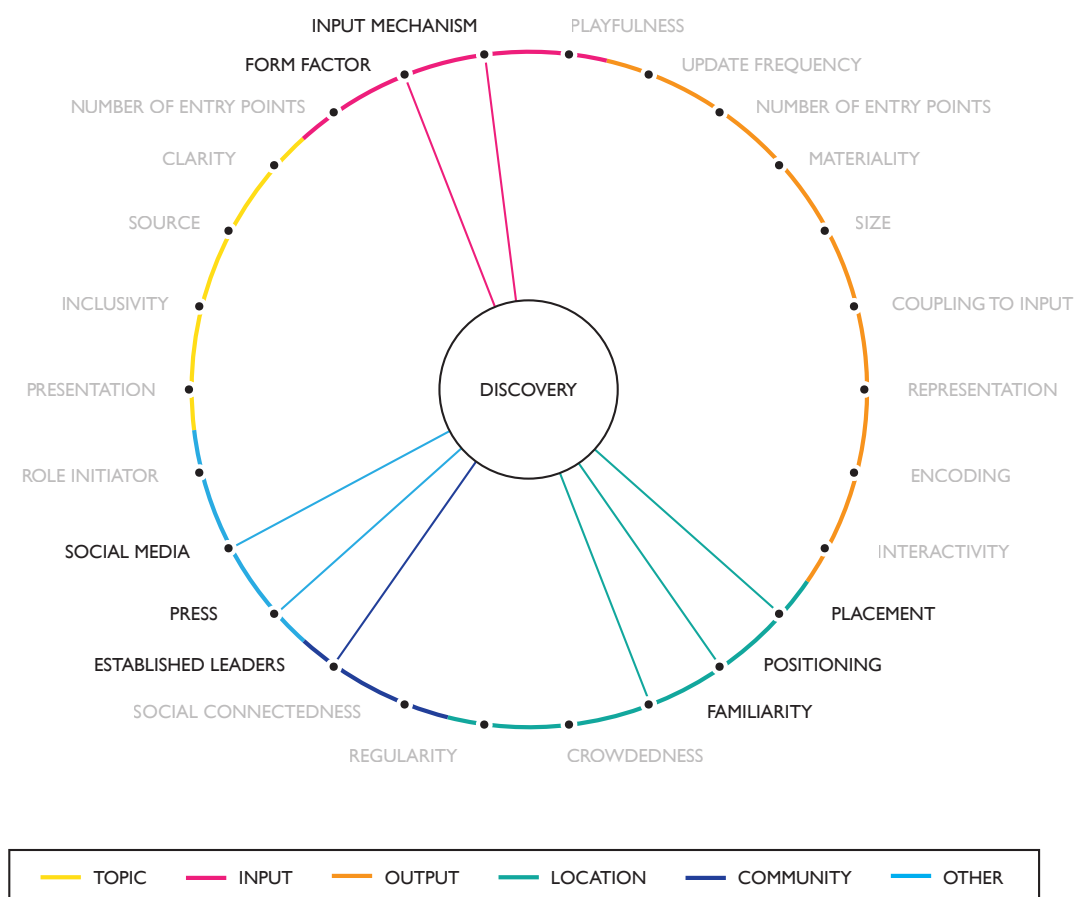
In the sharing stage, people **discussed** the Typewriter with others in the vicinity, and more often: they discussed the topic the installation addressed. Furthermore, **championing** behaviour was regularly observed, with people actively trying to encourage others to either participate by providing input, or to view the output. Some people also **published** information about the project on social media.

The Urban Typewriter evoked a variety of types of engagement. The unusual appearance of the device sparked **curiosity**, which made people approach the installation to investigate its purpose. Once near the Typewriter, many took the time to **explore** the three panels, by **reading** the posed question, the messages printed on the log, and the visualisations. In addition, people **contributed** by typing and submitting one or more messages. Often, interactions with the Typewriter took place in groups, with one person taking the lead. In addition to **collaborating** while interacting with the installation, people also **submitted messages on behalf of others**. A selection of people also engaged in **championing** behaviour, where they actively encouraged others to interact with the Typewriter, for example by leading them to device and explaining to them what to do.

The three panels received different levels of attention, with the input panel attracting most people, followed by the data output panel, and finally the visualisation panel. Those reading the collected data and visualisations often **discussed** the question posed by the Typewriter, other people's contributions, and their own perspective. In group sessions, one person typically read the messages and visualisations out loud, thereby sharing the content with all the people in the group.

## 9.5.2 Design and contextual factors

### 9.5.2.1 Discovery and rediscovery



**Figure 9.25:** Factors framework: factors relating to discovery

#### Form factor

Due to its size and appearance, the installation stood out in the three selected locations. As a result, people immediately noticed its arrival, in particular those highly familiar with the environment (see 'Familiarity with location').



**Input mechanism**

The distinct sound produced by the pressing of the large buttons on the keyboard emerged as an unexpected tool for evoking the honeypot effect, as it drew people in who were curious to find out what was happening.

**Placement**

By placing the installation in three key locations in the area, that are already part of people's existing routines, the project was embedded in the community. This confirms the earlier findings from the Visualising Mill Road study (Chapter 4), which highlighted the importance of understanding the existing practices of the community.

**Positioning**

In addition to placement, the positioning of the installation in relation to its surroundings again proved to be important – confirming earlier findings, in particular those from the VoxBox studies (Chapter 6 and 7). Again, the positioning of the installation along main walkways, in a manner that makes both input and output highly visible, ensured that people noticed the display, and that they were able to approach it without significant effort.

**Familiarity with location**

During the deployment it emerged that those familiar with the involved venues, such as the church and school, immediately noticed the arrival of the Typewriter. This familiarity with the locations facilitated discovery.

**Established leaders**

Some of the people working in the participating venues actively introduced people to the installation, championing its use – similar to the role of the shopkeepers in the Visualising Mill Road study (Chapter 4). Their pre-existing relationships with local residents ensured that people trusted their advice, and because of this their championing activities were typically highly effective, meaning more people discovered and approached the installation.

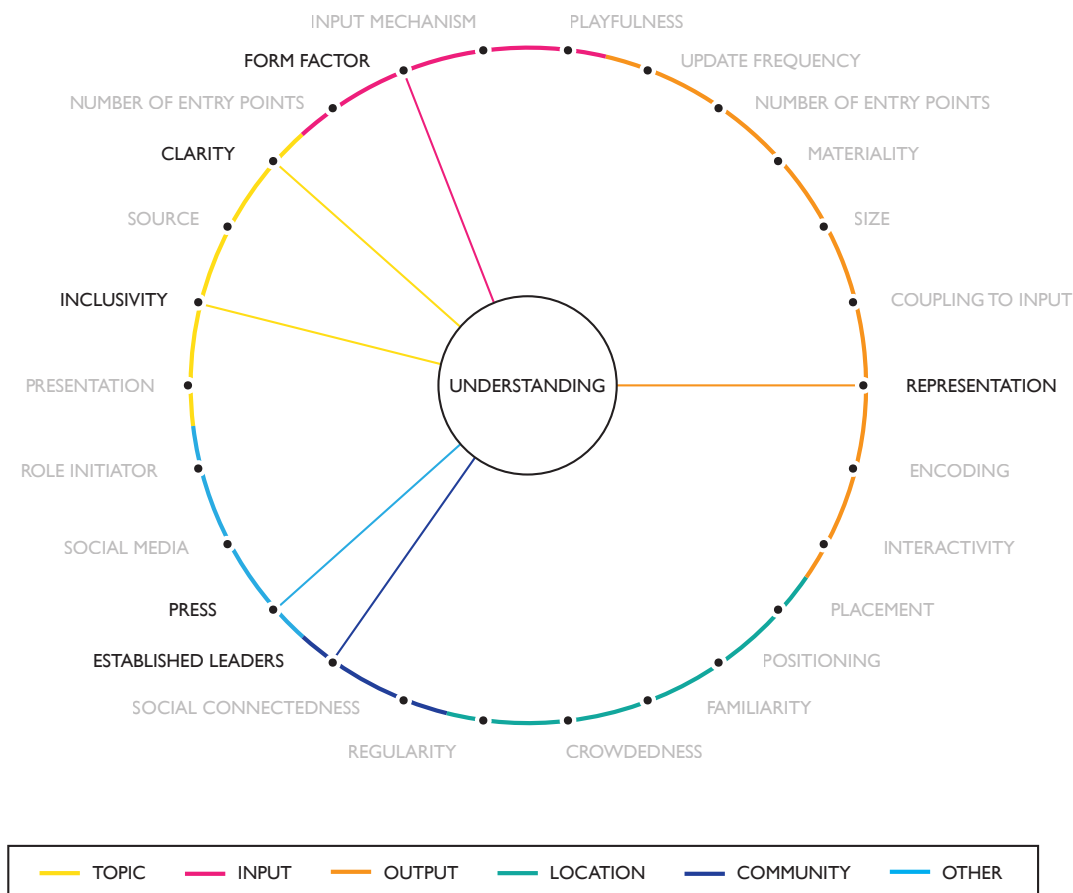
**Press**

While the role of the media was small in comparison to the Visualising Mill Road study (Chapter 4), publicity by the council about the consultation and installation increased awareness of the project, and motivated some people to visit one of the participating venues.

## Social media

Posts about the installation on social media further promoted the project, increasing discovery of it online.

### 9.5.2.2 Understanding



**Figure 9.26:** Factors framework: factors relating to understanding

#### Inclusivity of topic

The focus of the consultation, the future of a local park, proved a highly inclusive and accessible topic, as all people in the area were familiar with this park. Furthermore, the question itself could be comprehended by a wide range of ages, making it suitable for deployment at the school as well as the other venues.

#### Clarity of topic

The phrasing of the question by the council proved highly effective, as it made the intention of the installation clear to people of different ages and background. In addition, the question made it clear that the installation was part of a consultation – a process which people

were generally familiar with. This clarity improved understanding, as it communicated the project's intention and set expectations.

**Form factor**

The shape and size of the installation allowed people to look at the input, output, and visualisations panels. Furthermore, it enabled bystanders to observe how others used the installation, which allowed people to easily get an understanding of the device's capabilities without risking embarrassment. This findings corresponds with the findings from VoxBox (Chapter 6 and 7), showing that larger installations facilitate understanding.

**Representations of output**

The use of icons and rounded percentages was found to communicate the collected data to people from different ages and backgrounds, including children, without requiring assistance from others. Furthermore, as a series of such visualisations were displayed simultaneously, people were able to compare the popularity of different suggestions.

**Established leaders**

The presence of familiar people – such as staff members of the participating venues – improved overall understanding, as people were able to ask these established leaders questions about the aim of the project and how to interact with the installation.

**Press**

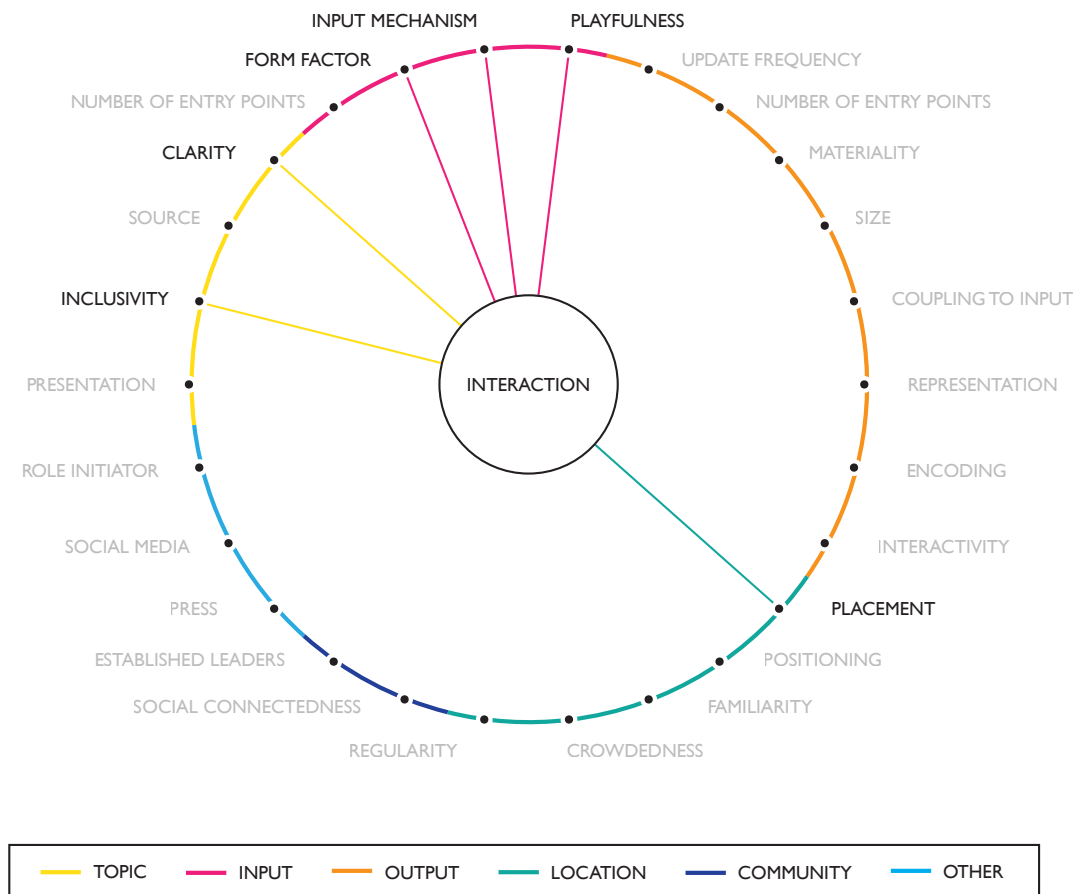
The coverage of the consultation and the presence of the Typewriter in local media provided people who read these articles with an understanding of the aim of the installation.

**9.5.2.3 Interacting****Inclusivity of topic**

The question posed was found to be easy to understand, and the topic highly relevant to people living and working in the area. As a result, people were not only able to take part but also motivated to have their say.

**Clarity of intent**

Due to people's familiarity with council consultations, the objective of the installation was obvious to most people. While some expressed scepticism about how the submitted suggestions would be used, all understood that the messages would be viewed by the council



**Figure 9.27:** Factors framework: factors relating to interaction

– which encouraged them to take part in the hope that their opinion would be taken into consideration.

### Form factor

The size and openness of the installation enabled collaborations, as these characteristics made it possible for multiple people to convene around the input panel.

### Input mechanism

For the majority of people, the input mechanism proved easy to use. The familiarity of the keyboard made it possible for people of different ages and backgrounds to interact without requiring support or guidance. However, for a small group of elderly people the mechanism was reminiscent of typical desktop computers, which they knew would not be able to use independently. While this prevented them from interacting directly, many were observed asking someone in the vicinity to interact on their behalf.

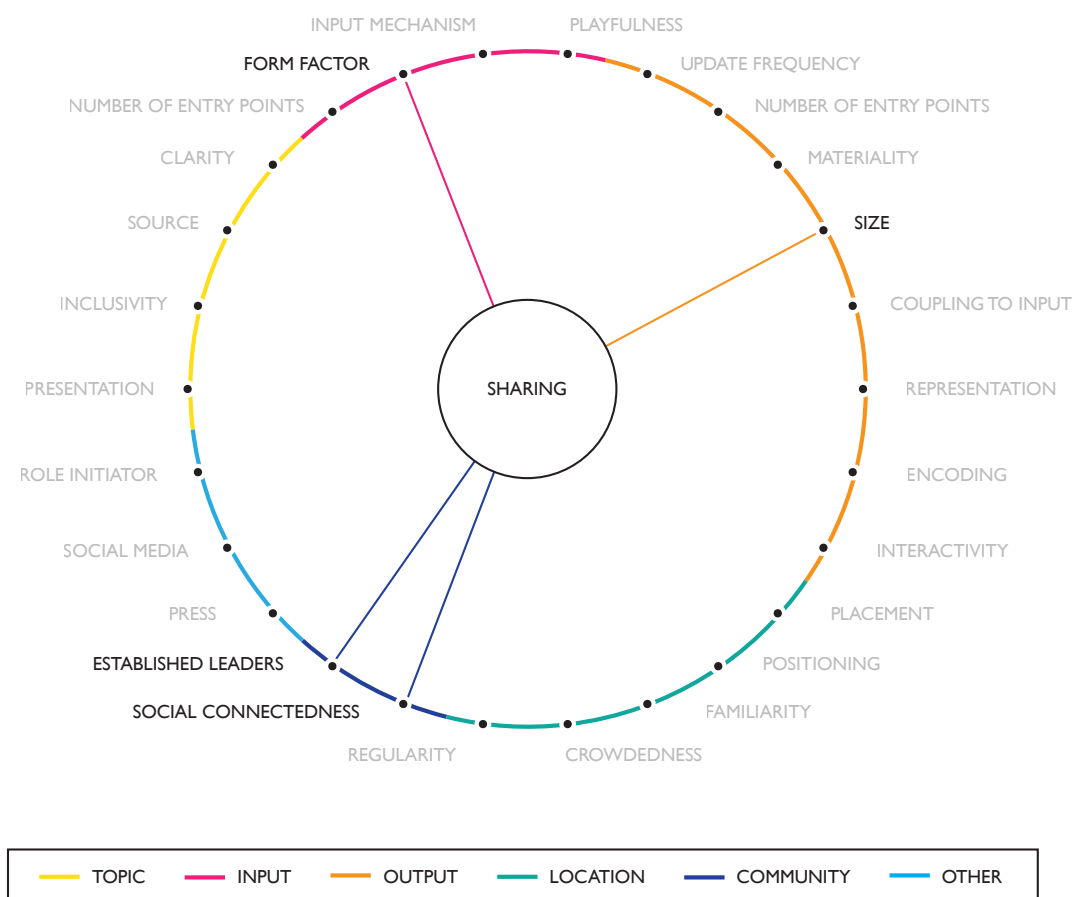
## Playfulness

The direct feedback provided by the printer was found to give the installation a playful feel. People described the process of interacting as enjoyable and fun, which encouraged repeat interactions.

## Placement

The placement of the installation in central locations within the neighbourhood ensured that people were able to take part during their normal routines. This also allowed people to regularly return to submit additional suggestions.

### 9.5.2.4 Sharing



**Figure 9.28:** Factors framework: factors relating to sharing

## Form factor

As mentioned previously, the large size and openness of the installation made it possible for multiple people to convene around the input panel and the receipt panel. Furthermore, this also facilitated situated championing and discussions – where people actively tried to involve

other around them. While only a part of sharing behaviours took place near the installation, as opposed to in other locations or online, the form factor was found to play an important role in facilitating these behaviours.

### **Size of output**

In addition to the overall form factor, the size of the visualisations further promoted sharing, as they allowed multiple people to look at them simultaneously. People were regularly observed discussing the visualised data in front of the visualisation panel.

### **Social connectedness**

The pre-existing relationships within the community made it easier for people to take part in sharing behaviours, as many people were already acquainted or at least familiar strangers, and because of this taking part in championing or discussing was less likely to result in socially awkward situations.

### **Established leaders**

The role of established community leaders – such as the staff members of the participating venues and organisers of community groups – was highly important as these people were regularly observed championing the installation and encouraging discourse around the topic it addressed. Furthermore, these leaders often also published information about the consultation online.

## **9.6 Summary**

This chapter described the design and evaluation of a situated feedback installation, coined the Urban Typewriter. Informed by the findings from Chapter 8, this device was designed to elicit and display qualitative feedback from local residents. The Typewriter was deployed in a neighbourhood setting as part of the local council's consultation on the future of a local park and the events and activities people would like to see there. The study showed that the installation successfully elicited ideas and concerns from the local community, and encouraged people to view and discuss other people's ideas. Key in this engagement were – again – the involvement of established leaders, the placement of the installation in popular venues, and the ease of use of the input mechanism. Furthermore, the immediate printing of submissions enabled people to view the opinions of others, which was found to not only spark discourse but to also act as inspiration for suggestions. The study raises a number of question

around the moderation of publicly submitted and displayed messages and the accountability of the organisation collecting data. Historical experiences with the local council were found to impact people's willingness and enthusiasm to participate, showing the importance of transparency around how and when collected data will be used.

In the next chapter the findings from all case studies are used to develop the Urban Visualisation Framework. This framework aims to support the development of urban visualisation projects by outlining how design factors and contextual factors can affect different types of engagement.





## Chapter 10

# Discussion

In this thesis, the design and deployment of urban visualisation interventions has been investigated. The objective of this research has been to study how such interventions can facilitate engagement with local topics in the urban environment – as summarised by the following overarching research question:

**How can situated urban visualisation interventions facilitate engagement with local topics?**

In a series of six in-the-wild studies, different design and contextual factors were investigated. From the findings it emerged that urban visualisation interventions can evoke a variety of engagement behaviours. Furthermore, these studies provided insight into the design and contextual factors that affect this engagement. Overall, the studies showed that the most effective installations were those that evoked both engagement with the installation as well as with the topics it addressed. Examples of such installations include the Visualising Mill Road (Chapter 4), VoxBox (Chapters 6 and 7), and Urban Typewriter (Chapter 9) interventions, which received many data submissions and also elicited a large variety of social interactions. The design of the input and output were found to be particularly key in fostering engagement.

From the literature review it emerged that the use of personal devices as input technologies – such as mobile phones with Internet access – can limit participation. As the approach of using personal devices means that there is no physical input technology presence within the setting, people may not realise that they can take part and have their say. Furthermore,

not everyone possesses or carries such devices, which means that the intervention is not accessible to all passers-by. To overcome these limitations, the case studies explored the use of situated input technologies, ranging from off-the-shelf tablets to custom voting devices. The use of off-the-shelf technology was found to occasionally evoke associations with familiar data collection practices, such as street marketing and monitoring by councils. As a result, a proportion of people were hesitant to engage. The use of stand-alone installations, however, was found to be highly effective in attracting people to the devices and encouraging them to participate – in particular when use was made of simple input mechanisms like arcade buttons (e.g. Chapters 4 and 6). In contrast, more complex input mechanisms, such as keyboards (e.g. Chapter 9), were found to act as barriers to participation for people who were not familiar with computing technology. This highlights a trade-off between the inclusivity of the input mechanism and the richness of the data it can elicit. Similarly, the playfulness of the input technology was found to influence participation, with highly playful installations being considered unsuitable for the submission of serious feedback (e.g. Chapter 8). The findings also showed that situated input technology can facilitate social interactions by enabling people to convene around the installation. This, in turn, was found to encourage collaboration and discussion: people collaboratively submitted suggestions, talked about the issues the intervention addressed, and convinced those around them to take part too. These social behaviours occurred in event settings (e.g. Chapters 6 and 7) as well as neighbourhood settings (e.g. Chapters 4 and 9).

Similarly, the literature review also revealed that the use of existing public displays does not guarantee that people will discover – let alone read or discuss – an output installation. The case studies, therefore, explored the use of alternative output methods. The findings from these studies showed that a clear coupling between input and output, combined with the use of eye-catching and highly visible displays was most effective in facilitating engagement. For example, output displayed on surfaces that people pass as part of their existing routines – like pavements and walls (Chapters 4 and 5) – were far more successful in promoting discovery than displays positioned on stand-alone installations (e.g. Chapters 6, 7, and 9). While the former enables people to view the data at a glance, the latter typically has smaller displays which require more active participation as people need to approach the installation to read the data. Similarly, the use of large, clear, and unambiguous data representations (e.g. Chapter 4) was found to be most easily accessible in public settings. In contrast, smaller, and

more detailed textual displays (e.g. Chapter 9) received less attention but promoted longer engagement, as – on average – people spent more time reading the submitted data. Across all studies the output received less attention than the input, with relatively few people reading and interacting with the data. As the concept of displaying data in-situ is novel, it is likely that people’s lack of awareness about the presence of visualisations played a big part in this, suggesting future work is required to investigate how to design urban visualisation interventions that clearly convey the presence and purpose of the output. Nevertheless, the findings indicate that publicly displaying hyperlocal data is a promising approach to engaging people in reading, interpreting, reflecting on, and discussing local issues in a situated manner.

In addition to the design of the input and output, the topic addressed by the intervention, and the deployment context were found to be highly important. The engagement behaviours that the installations evoked as well as the factors that affected this engagement are discussed in detail in the following sections.

## 10.1 Types of engagement

The first research question examined in this thesis relates to the types of engagement publicly situated input and output technology can encourage:

**RQ1: What types of engagement do urban visualisation interventions evoke?**

Findings from the six case studies revealed that the types of behaviours evoked by the public collection and visualisation of hyperlocal data can be categorised into four stages of engagement, from discovery to understanding, interaction, and sharing. Typically, people progress through these stages consecutively, over a period that can last between several seconds and several days.

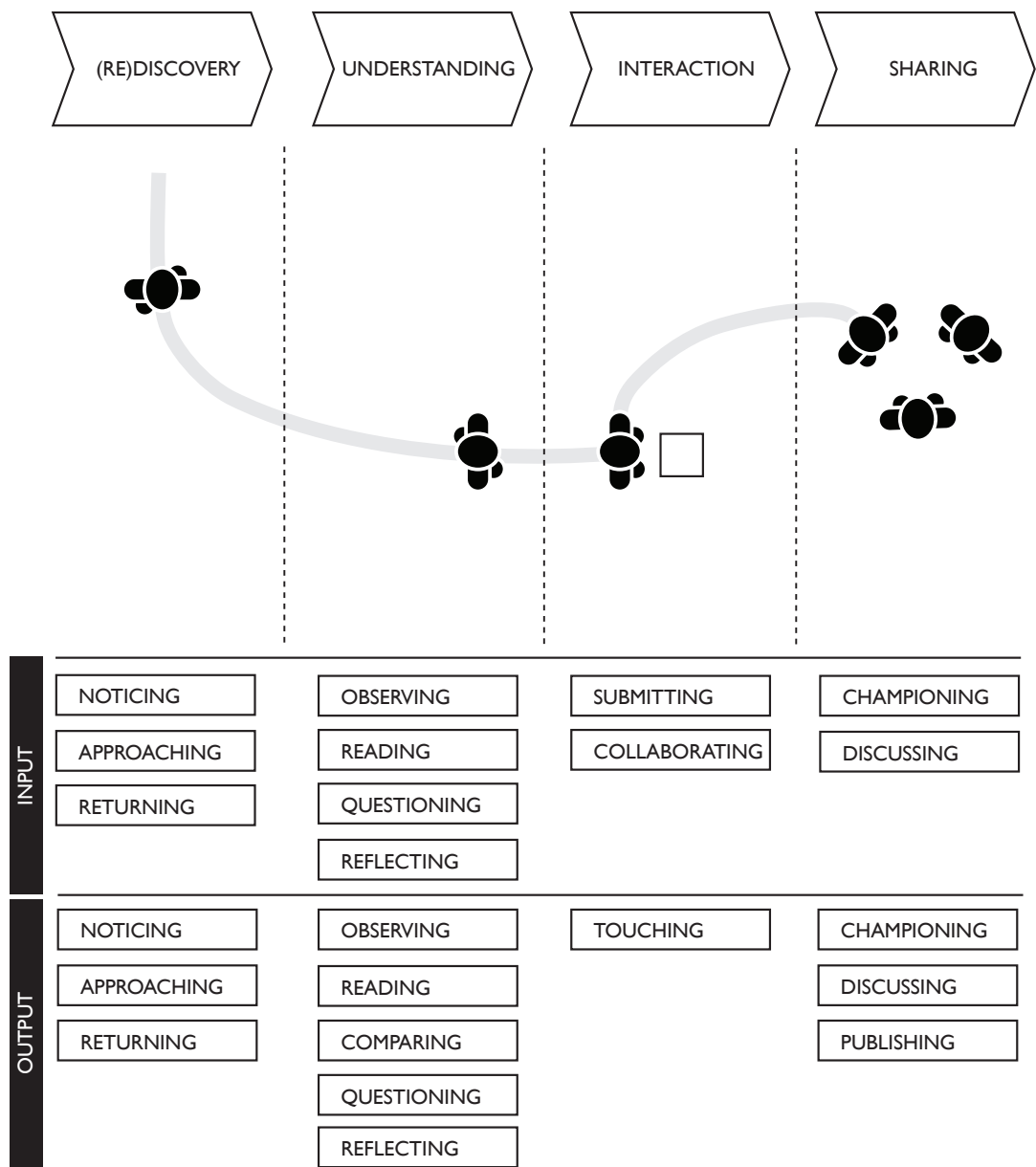


During the four stages of engagement, people were observed engaging with the interventions in a several ways, as shown in Figure 10.1. A total of 14 distinct engagement behaviours

were identified, ranging from passive engagement to active engagement. In the discovery stage, people typically noticed and approached the input technology. A less common behaviour was the return of people to the installation at a later time. In the understanding stage, people read the available information on both the input technology and output. Furthermore, people frequently observed how others used the installations. In the interaction stage, people submit their perceptions through the available input mechanism. Some installations were found to enable collaboration during this interaction process, however, this behaviour did not occur in all studies. Similarly, some visualisations were found to encourage tangible interaction, with people directly touching the representations. In the sharing stage, people discussed the intervention – typically the topic addressed by the intervention. Some studies also evoked active championing and publishing behaviour, where people encouraged others to take part or learn more about the project. However, this behaviour was found to be less common.

Importantly, the studies revealed that several of the engagement behaviours were not by definition dependent on people's proximity to the installations. The behaviours observed in the sharing stage, in particular, often took place remotely.

From the case studies it also emerged that the deployments in neighbourhood settings (see Chapter 4 and 9) evoked most diverse types of engagement. This is likely related to the duration of the deployments, the existing relationships people have with others in the area, and the direct connection between the topics addressed by the intervention and their personal living environment. These factors are discussed in more detail in Section 10.2.



**Figure 10.1:** Engagement framework showing the identified types of engagement with the input and output

## 10.2 Factors affecting engagement

The second research question investigated the role of the design on engagement:

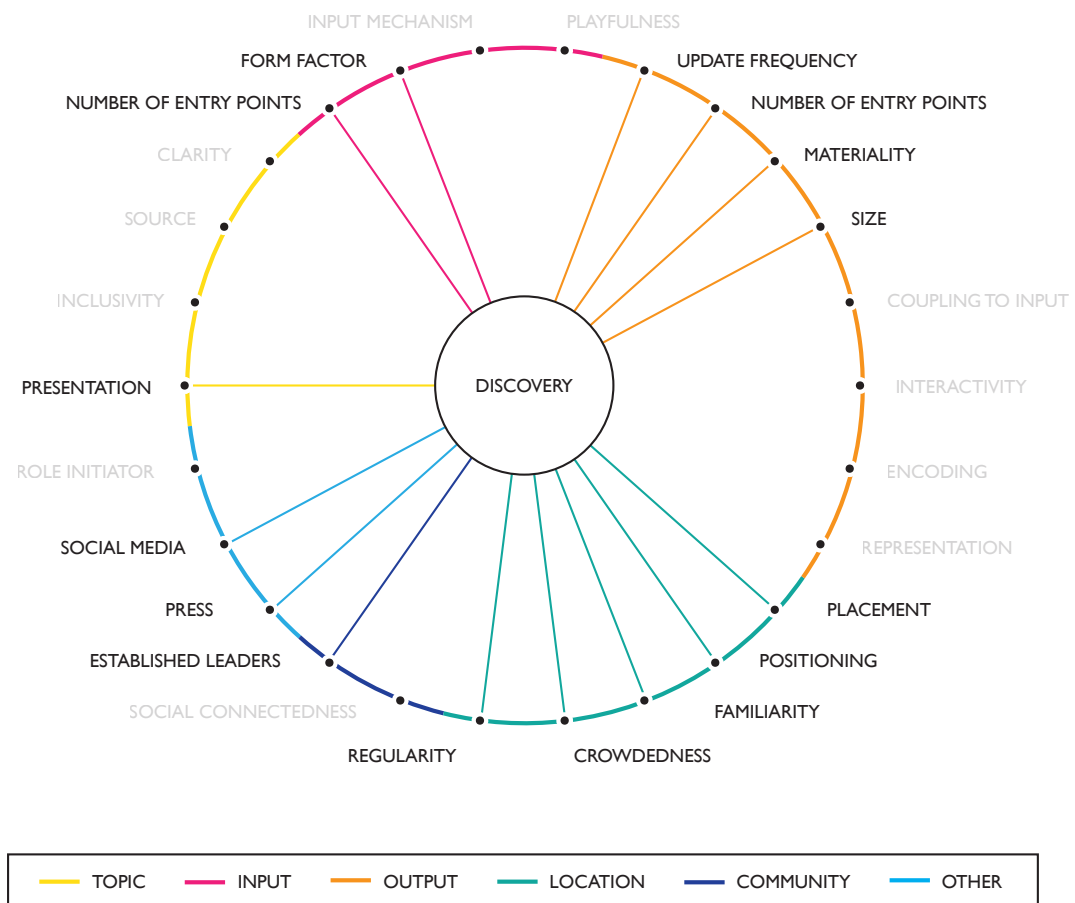
**RQ2: What design factors affect engagement with urban visualisation interventions?**

Findings from the studies it emerged that a variety of factors relating to the topic, input, and output design, affect engagement with urban visualisation interventions. To map these factors, a framework of factors was developed iteratively throughout the case studies, identifying a total of 16 design factors. These factors are discussed in detail in the upcoming sections.

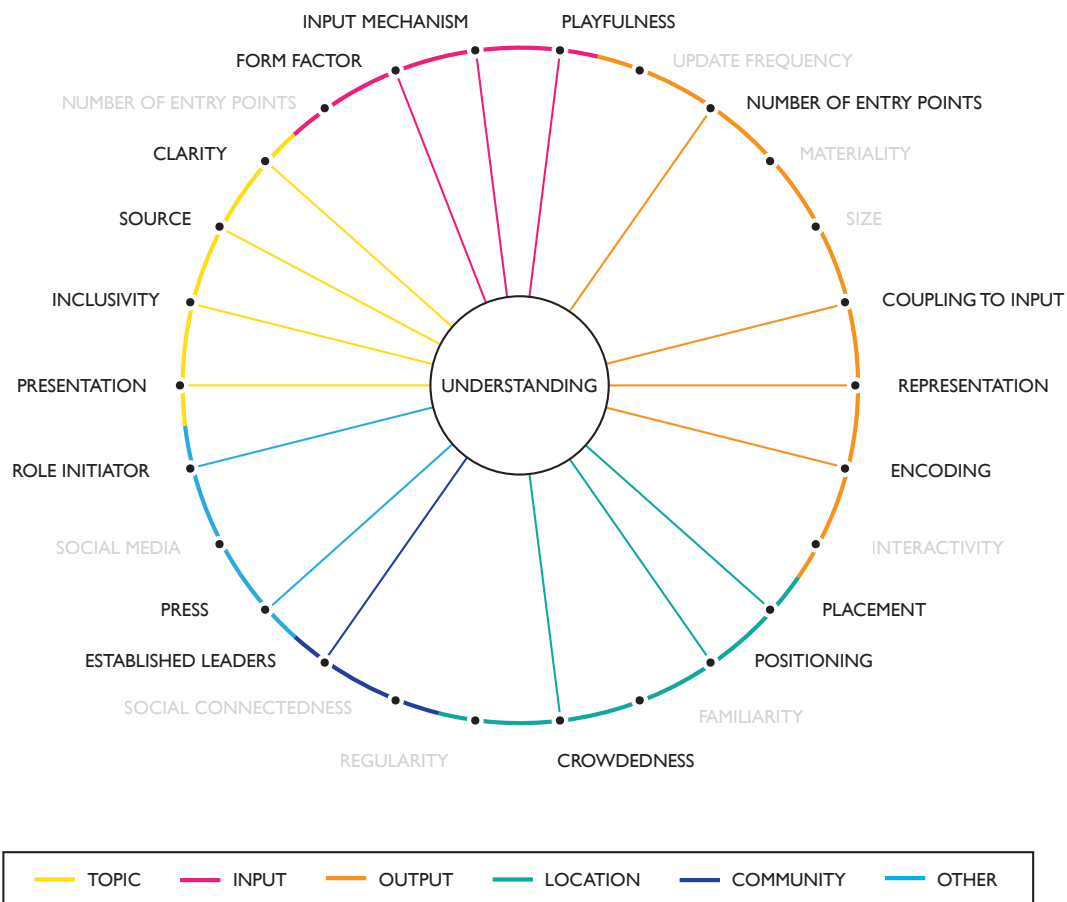
The same approach was used to map contextual factors, addressed by the third research question:

**RQ3: What contextual factors affect engagement with urban visualisation interventions?**

Factors relating to the location of the deployment, the social setting within this location, and several other contextual aspects were found to affect engagement. These factors, too, were mapped in a framework which is discussed in detail in the following sections.

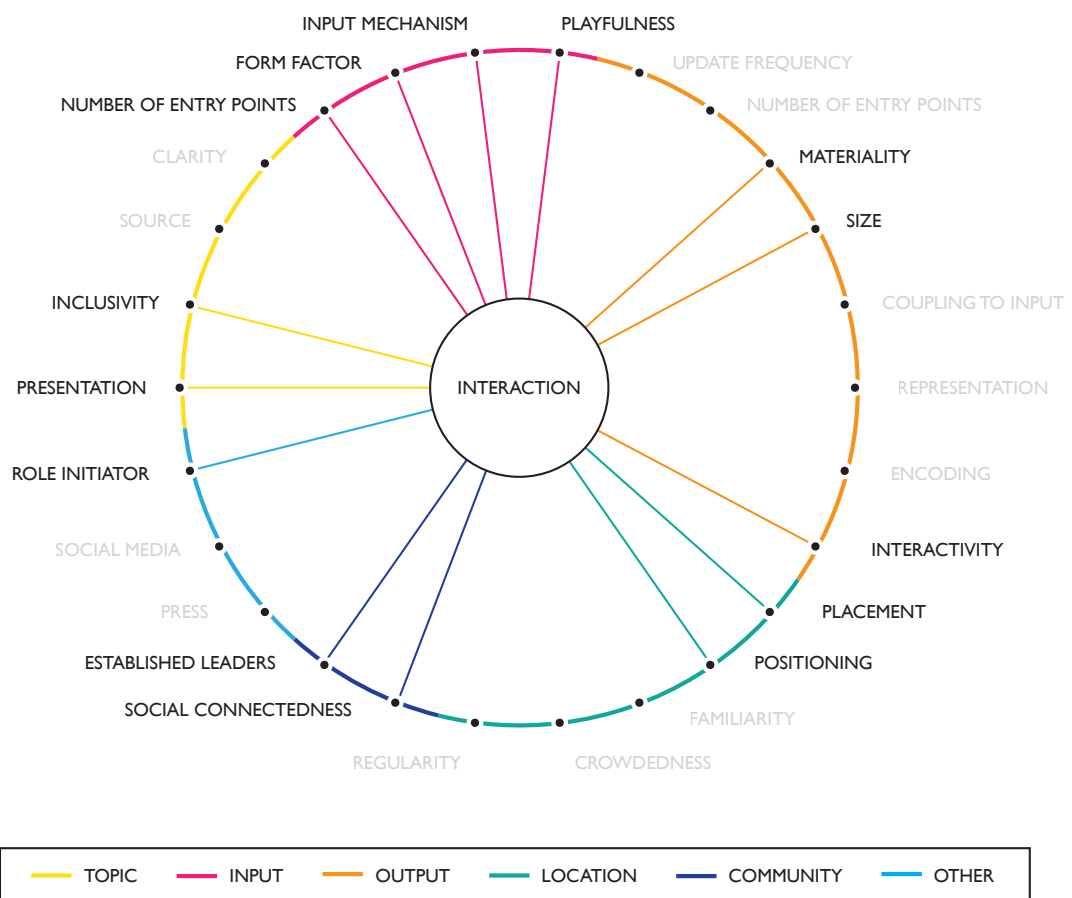


**Figure 10.2:** Factors framework: discovery. To facilitate discovery, the consideration of contextual factors is particularly important. Those include factors related to the location of the deployment, such as the placement and positioning of the intervention, people’s familiarity with the environment, and the regularity and crowdedness of the setting. With regards to the design, the output typically plays an important role in getting people to notice the installation, making the number of entry points and size of the output key to promoting discovery.

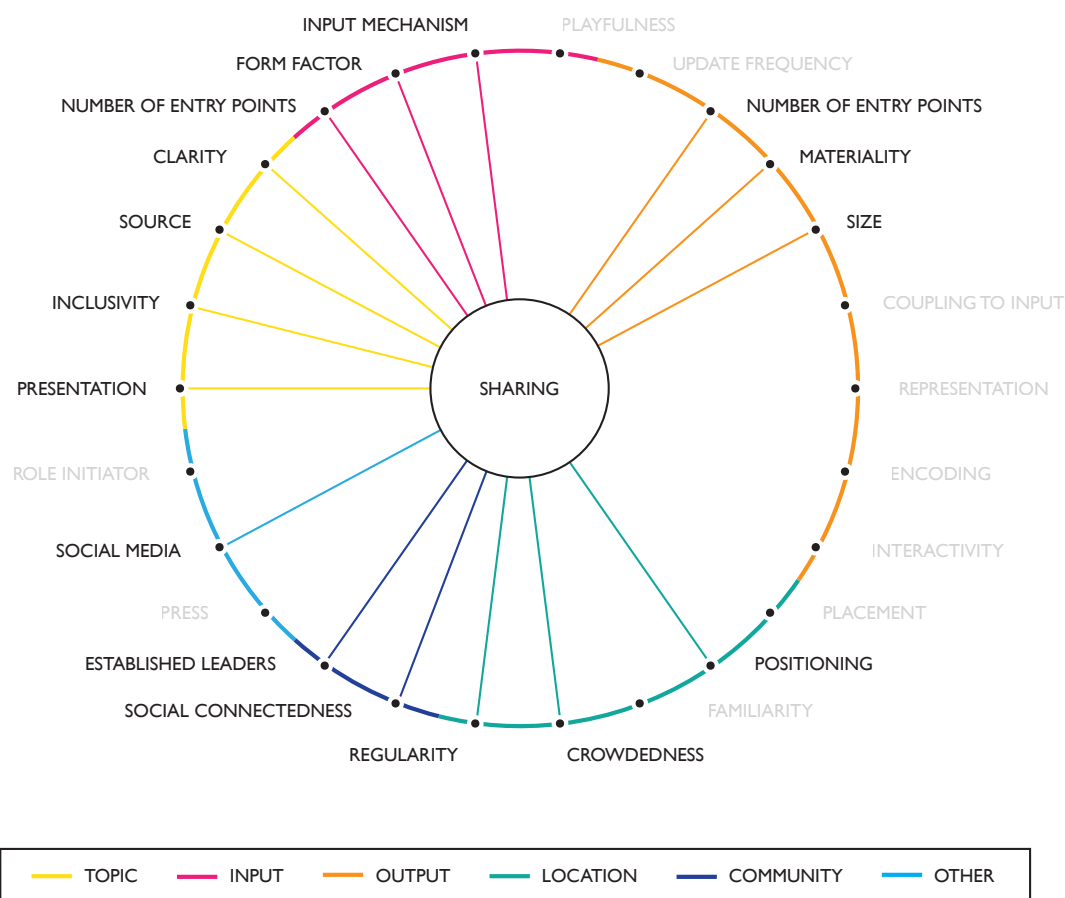


**Figure 10.3:** Factors framework: understanding. The design of the intervention is key to facilitating understanding, especially factors relating to the topic.

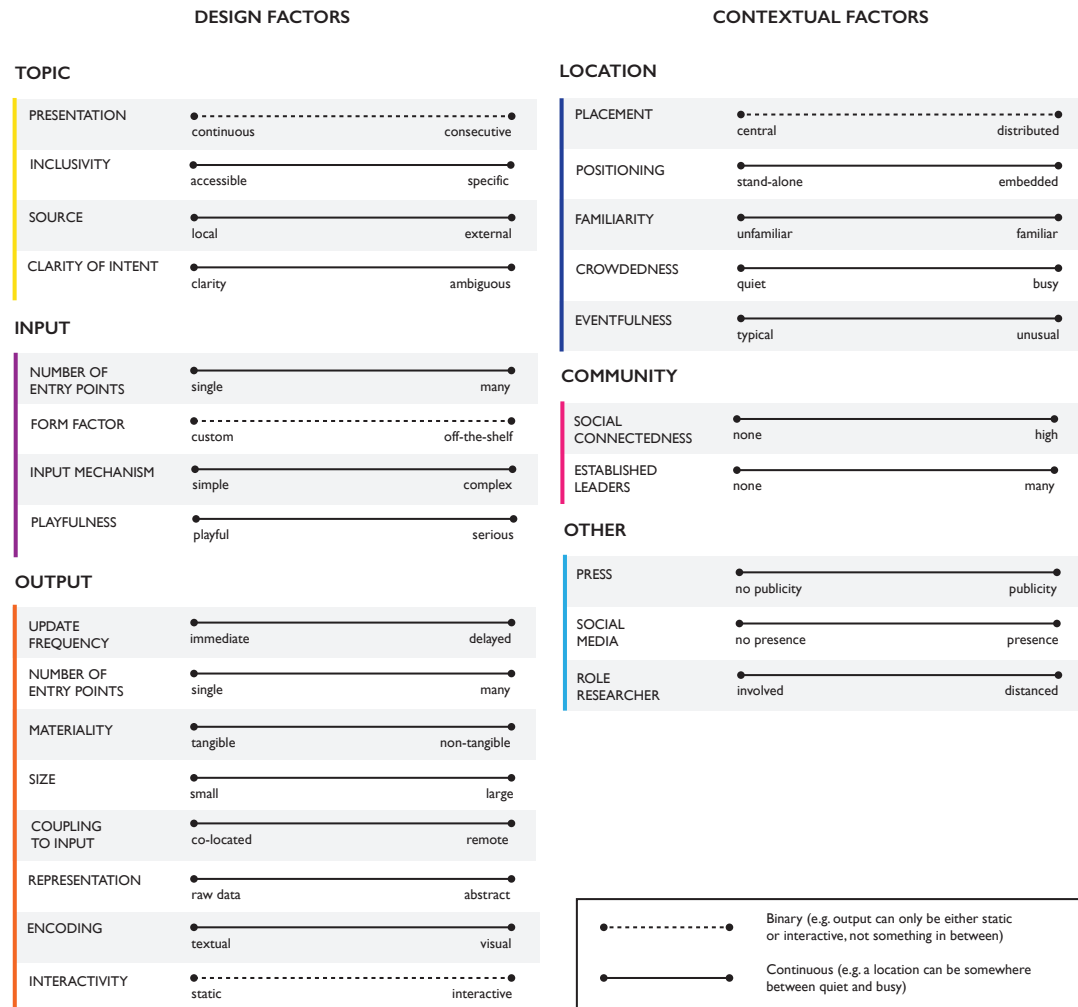




**Figure 10.4:** Factors framework: interaction. In order to facilitate interaction, the design of the input technology is particularly important.



**Figure 10.5:** Factors framework: sharing. To facilitate sharing, consideration should be given to both design and contextual factors, in particular the topic design and the social setting of the deployment context.



**Figure 10.6:** The Dimensions framework describes the characteristics of each factor and should be consulted in combination with the corresponding factor descriptions outlined in Section 10.2

## 10.2.1 Design factors

### 10.2.1.1 Topic factors

#### Presentation of topics

Installations can address one or more topics, for example by presenting multiple questions simultaneously. Alternatively, questions can also be replaced over time. This process of replacing questions was found to promote rediscovery, as it encouraged people to return at a later stage to see the new question. For example, during the Visualising Mill Road study described in Chapter 4 the revisitation of the input technology was found to be common, particularly once people started understanding the rhythm of the updates. On the other hand, the continuous presentation of the same question(s) ensures that people can return to the installation to answer it another time, or to add suggestions. For example, during the Urban Typewriter study described in Chapter 9 people were found to return to the installation after considering their answer overnight.

continuous    ●-----●    consecutive

The use of continuous topics is most appropriate for settings that people only visit once (e.g. events) or single-topic deployments (e.g. consultations). For settings that are visited by the same people on a regular basis, such as workplaces and neighbourhoods, the use of consecutive questions can help sustain engagement over time, provided that the pacing is appropriate and informed by people's pre-existing behaviours.

#### Inclusivity of topics

Posed questions and statements can either be highly accessible or more specific and targeted at a certain demographic.

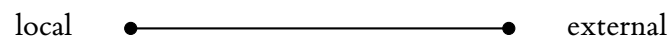
accessible    ●—————●    specific

Accessible topics are most suitable for settings that attract people from a wide range of backgrounds. The use of accessible topics is most relevant for interventions that aim to reach out to as many people as possible (e.g. organisers of an event may want feedback from many, if not all, attendees). Specific topics, on the other hand, can help target a certain audience (e.g.

during a community consultation a council may want to target locals rather than visitors of the area).

### Source of topics

Questions and statements can be conceived and formulated by local people (e.g. residents, shopkeepers), external people (e.g. visitors, researchers from another city), or a combination of both.

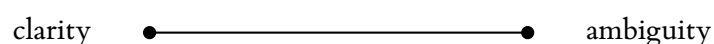


Locally sourced topics are particularly suitable for more permanent settings, such as neighbourhoods, where there is a shared history, a common knowledge of current issues, and potentially an existing feeling of community. In these types of areas, background knowledge of the area can be valuable as this knowledge can ensure the selected topics are timely and relevant to the people in this area. Involving locals in the process of sourcing topics can, however, be a time-consuming task, and may require the initiator of the intervention to carefully navigate stakeholder interests and local politics.

Sourcing topics locally is not always an option. At events, for example, there may not be an existing community or shared history, and reaching out to attendees before the event may not be possible. The benefit of external people in both neighbourhood and event settings, however, is that their lack of background knowledge allows them to formulate topics that are highly accessible to locals and non-locals.

### Clarity of topics

Topics can either be very clear, addressing a well-defined subject, or they can be more ambiguous.



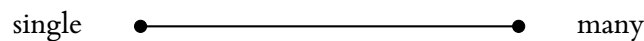
Clarity ensures that people interpret the posed question or statement in the exact same manner. By clearly communicating the topic, the provided feedback is likely to elicit highly relevant responses. In contrast, ambiguity allows for multiple interpretations and as a result can evoke discussion and more diverse responses. However, when a topic is too ambiguous,

it can instead create confusion and act as a barrier to participation. A high level of clarity is most suitable for consultation-like interventions, while a high level ambiguity is most suitable for informal and playful interventions that are less focused on the data and more on the social interactions around the installation.

### 10.2.1.2 Input factors

#### Number of entry points

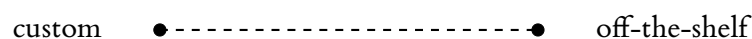
Input technology can be placed in a single central location, or at multiple different locations.



Single entry point deployments are most appropriate for projects that aim to reach out to a select number of people in an area (i.e. a sample). When the aim is to reach out to all people, the use of multiple entry points is usually more suitable, as this allows multiple interactions to take place simultaneously.

#### Form factor

One of the key considerations for the design of the input is the choice between using custom technology, which allows for the creation of a form factor specific to the project, or using off-the-shelf technology



A custom form factor is typically costly and more time-consuming to produce. However, because it can be designed to fit the needs of the specific project and setting, it can be made to be more eye-catching than off-the-shelf technology – which in turn can support discovery of the intervention. Off-the-shelf technology, however, is often usually more affordable. Furthermore, because people are generally familiar with these devices, the technology can be more accessible. However, the choice of form factor should be taken with care, as technology social preconceptions can potentially affect engagement. For example, during the Fair Numbers study described in Chapter 5, the use of tablets which were held by researchers was found to be associated with salespeople which was found to deter engagement.

### Input mechanism

The input mechanism used to collect data can be anywhere from simple to highly complex.

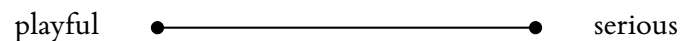


Simple input mechanisms, such as push-buttons, generally collect equally simple data that is of relatively low quality (e.g. containing repeat votes). More complex input mechanisms can instead enable the submission of richer data, such as qualitative input. However, these complex mechanisms are typically less inclusive, as using them requires more effort – and sometimes even more knowledge of the technology. Depending on the aim of the intervention, an appropriate balance should be sought between the richness of the data and the inclusivity of the input mechanism.

In addition, the choice of input mechanism can affect peripheral awareness of the intervention. For example, the keyboard used in the Urban Typewriter study described in Chapter 9 produced a distinct clicking sound when used which was found to catch the attention of passers-by. Similarly, the use of colourful tangible input mechanisms in the VoxBox studies described in Chapters 6 and 7 was also found to attract the attention of passers-by. Furthermore, the combination of multiple input mechanisms in the VoxBox studies was found to evoke curiosity, with people wanting to progress through the questions in order to be able to use the different mechanisms.

### Playfulness of input technology

The input technology can be designed to facilitate a playful experience, or a more serious interaction.



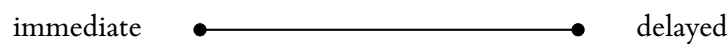
Highly playful input technology can provide a more enjoyable experience which can motivate people to interact with the installation, encourage others to take part, and to return at a later stage. However, again a balance should be achieved between the intention of the installation and the level of playfulness. When interventions are too playful, people may no longer view them as a legitimate medium for serious feedback, which can discourage them from interacting with the technology. For example, in the Scribbles, Magnets, Typewriter

study described in Chapter 8 the use of fridge magnets as input was found to be too restrictive, limiting people's expressiveness to an extent that hindered communication. As a result they were unable to convey their opinions and interpret the submissions of others, deterring engagement.

### 10.2.1.3 Output factors

#### Update frequency of output

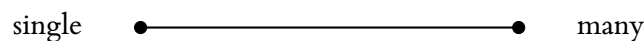
Visualisations of collected data can show updates in real-time, or in a delayed manner.



Immediate updates act as feedback, instantly confirming that people's responses have been recorded. Furthermore, by adding recently submitted data to the overall bulk of data, people can see how their contribution affects the big picture. In contrast, delayed updates can create a feeling of suspense and anticipation, and can encourage people to return to the installation at a later stage. As such revisitation is less likely to happen at short-term settings (e.g. events), immediate updates are more appropriate for short-term settings, while delayed updates are more appropriate for longer deployments in neighbourhoods and workplaces. For example, the delayed updates in the Visualising Mill Road study described in Chapter 4 were found to evoke curiosity and encourage revisitation, while such a delayed updating process was not found to be as affective in the Fair Numbers study described in Chapter 5, which took place during a one-day event.

#### Number of entry points for output

Similar to the input, visualisations can also be designed to have one or more entry points.



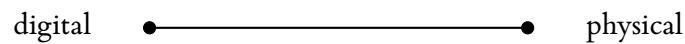
Single entry points can be sufficient in settings with central hubs which are frequented by the target audience. Such a central approach can, for example, motivate people to visit these convenient locations more frequently. Multiple entry points, on the other hand, are more suitable for areas without central hubs, where only a distribution of visualisations can reach the wider community, see for example the involvement of multiple shops in Visualising



Mill Road (Chapter 4). This approach is, however, typically more costly and more difficult to evaluate.

### **Materiality of output**

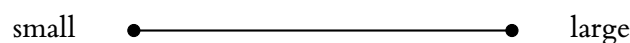
The data can be visualised digitally or in a more physical manner.



The use of a digital visualisations, such as representations displayed on screens, can enable a wide range of interactions at relatively low effort and cost for the initiator and facilitators. Similarly, digital visualisations can be easily updated in real-time. However, due to people's familiarity with these types of displays in the context of advertisements, this approach is more susceptible to display blindness. Physical, more analogue visualisations, such as tangible data sculptures and chalk graffiti representations, can be more eye-catching and inviting due to their unusual appearance. However, they are typically more costly to produce, harder to develop, and more difficult to update. Therefore, a balance should be achieved between practicalities and the appeal of the output.

### **Size of output**

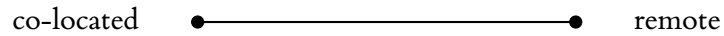
The output can be physically small or large in size.



Large visualisations are generally more visible and eye-catching, and as a result more likely to be noticed by more people. However, due to restrictions imposed by regulations for the public environment or the budget, the use of large visualisations may be less achievable. Furthermore, the scale of a visualisation should be appropriate for the aim of the intervention and the environment – enabling passers-by to consume the presented information at a glance.

### **Coupling to input**

The visualisation can be displayed in the vicinity of the input technology, or shown elsewhere.

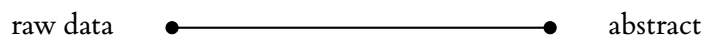


By co-locating the input and output, people will be able to easily understand the link between the two. However, creating distance between the input and output can help reach a wider audience, by embedding the intervention in more locations. In addition, by placing the visualisation elsewhere, it can act as a lure, motivating people to visit the input technology. For the coupling to be effective, however, the link between input and output needs to be obvious. Therefore, a remote approach is less suitable for event settings, where many other activities in the same environment are competing for the attention of passers-by, and a link between two remote elements is less likely to be recognised.

However, a remote approach is more suitable in neighbourhood or workplace settings, where people are generally highly familiar with the environment, and as a result will notice the link more easily. Furthermore, in these environments, the duration of an intervention can be longer, providing people with more time to understand the coupling.

### Representation

The collected data can be displayed in its raw form or presented in a more abstract way using visual representations.

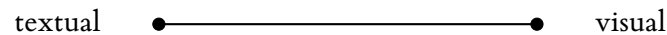


The primary aim of the visualisations is to make the data easy to interpret. As a result, data displays often rely on simple visual representations, which tend to be highly accessible to a wide range of people. However, in comparison, the display of raw data – textual data in particular – can provide nuances that are obscured by the aggregation that is typically required for more visual representations. While the former can provide appealing and clear summaries of the data, the latter shows the data in more detail and presents a more direct insight into the individual contributions. Depending on the aims of the intervention, and the engagement behaviours it is designed to evoke, a balance should be sought. Abstract representations are particularly suitable for large sets of simple data (e.g. votes). These representations can, for example, enable comparison behaviour. Raw data representations, on the other hand, are more suitable for textual data. These representation can, for example,

facilitate reading.

### Encoding of output

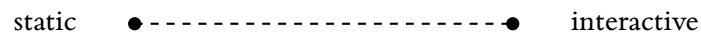
The collected data can be encoded as textual, visual, or a combination of both.



Visual encodings, such as graphics, enable people to interpret the collected data at a glance. This approach is particularly effective in settings where people have little to no time to study the data, such as events. However, visual encodings are generally most insightful when the data complexity is low (e.g. votes) and when there are clear patterns in the data (e.g. one option is more popular than the others). When the data is more subtle and complex, such as qualitative feedback, textual encoding can provide people with a far richer picture of the collected data. However, textual encoding is only suitable in environments where people have the time and ability to read submissions.

### Interactivity of output

Output can be displayed in a static or interactive manner.



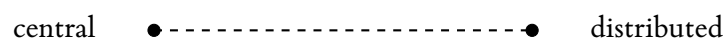
Static visualisations (e.g. chalk graffiti in Chapter 4, paper printouts of charts in Chapter 9) are typically easier to develop and less costly to create. Interactive output technology (e.g. tablets in Chapter 7), such as digital displays, however, enable people to explore the data, enabling understanding.

## 10.2.2 Contextual factors

### 10.2.2.1 Location factors

#### Placement

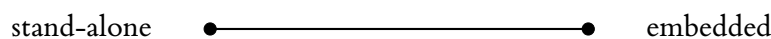
Urban visualisation interventions can be placed in a single central locations, or they can distributed across multiple locations.



In settings with central hubs which many people regularly frequent (e.g. squares, foyers) central deployments are highly suitable. Furthermore, the use of a central location can be sufficient when the aim of the intervention is to reach a sample of people, rather than all people (e.g. when trying to get feedback from all attendees of an event to evaluate their experiences). Multiple entry point deployments are, instead, more suitable for deployment settings in which there are no central hubs, and where distribution of input technology to a variety of locations can help reach a wider audience (e.g. when attempting to involve all residents of a neighbourhood) – see for example the use of multiple shops in the Visualising Mill Road study (Chapter 4) or the use of multiple community venues in the Urban Typewriter study (Chapter 9).

### Positioning

Within a location, interventions can be positioned in the setting as a stand-alone installation, or they can be more embedded into the setting's existing rhythms and routines.



The positioning of an intervention within a location can influence discovery. When an installation is, for example, embedded in existing community practices (e.g. positioned on counter of popular shop or positioned along main throughway) people are more likely to notice it. Furthermore, it ensures that people do not have to go out of their way to view or interact with the intervention. In order to embed a project in such rhythms and routines, however, knowledge is required of the location and the social behaviours within the location, which may require ethnographic work to be completed prior to the deployment. Alternative, an eye-catching stand-alone installation may attract people to a specific area instead. In addition to considering whether an installation should be stand-alone or embedded, attention also needs to be given to the orientation of the installation. For example, the orientation of the VoxBox in Chapters 6 and 7 was found to directly affect discoverability and engagement with the intervention, as people did not realise that visualisations were present.

### Familiarity of location

People within a location can have varying levels of familiarity with that environment.

unfamiliar ●————● familiar

In locations that people are unfamiliar with (such as events or neighbourhoods they have not previously explored), they are less likely to notice the presence of an installation – as all aspects of their surroundings are novel. In contrast, in familiar locations (such as neighbourhoods and workplaces) people are more likely to notice the presence of new installations or other new objects in the environment – as they are aware of what the setting usually looks like – thereby facilitating discovery. As a result, the response to the introduction of an intervention in a familiar location can also be more immediate. For example, in the school setting in the Urban Typewriter study described in Chapter 9 many children were observed immediately noticing the change in the setting as they walked into the school.

### **Crowdedness of location**

The location of deployment can be anything between quiet and busy.

quiet ●————● busy

Depending on the size of the intervention, they may be more visible in quiet locations installations as they are not hidden behind people. Furthermore, in quiet locations people have the ability to interact with the device without potentially embarrassing themselves in front of onlookers. In busy locations, however, the honeypot effect is more likely to encourage discovery. In addition, in these locations people can also observe how others interact with the intervention before personally engaging, which promotes understanding.

### **Regularity of location**

The location in which an installation is placed can have a typical level of activity (e.g. a normal day in a public square), or an unusual level of activity (e.g. an annual fair in a public square).

typical ●————● unusual

The level regularity of the location impacts the likelihood of an installation being noticed, approached, and interacted with. When there are many other unusual activities happening

in the vicinity, this can negatively affect engagement. However, such irregularities typically go hand in hand with the presence of a high number of people (e.g. events), which enables the intervention to potentially engage more people. In comparison, in highly regular settings (e.g. average day on a residential street) people are more likely to notice an intervention.

### 10.2.2.2 Community factors

#### Social connectedness of community

The people in the environment in which the deployment takes place can either not know one another, or they can have some degree of social connectedness.

none ●—————● high

Pre-existing relationships within a community can help facilitate engagement – sharing behaviours in particular – as these relationships allow people to interact with other without risking social awkwardness and potential embarrassment. However, in many public settings, like railway stations, public squares, and events, such connectedness is unlikely to exist due to the high number of people visiting and passing through.

#### Established leaders within community

Depending on the community, there may be one or more established leaders, with whom people have existing relationships.

none ●—————● many

When there no established leaders (e.g. at events where people do not know one another), pre-existing connections cannot help facilitate engagement. However, when one or more established leaders do exist, like community group organisers or staff members of key venues in the area, their role within the intervention can help increase discovery, understanding, interaction, and sharing. Especially when these leaders are trusted members of the community, their involvement can give credibility to the intervention. For example, in the Visualising Mill Road (Chapter 4) and Urban Typewriter (Chapter 9) studies people were observed discussing the intervention with the shopkeepers and staff members of community

venues before taking part.

### 10.2.2.3 Other contextual factors

#### Press

Interventions can be covered in the local, national, or even international press, or receive no media attention.

no publicity ●—————● publicity

Publicity can help increase engagement, as it often allows a wider audience to discover the project and to learn more about it. For example, when during the Visualising Mill Road study (Chapter 4) a local radio station and newspaper covered the project, people were observed entering shops to learn more about how to participate. However, while it is possible to contact media outlets, and send out press releases, it is typically difficult to influence whether the project will receive press coverage.

#### Social media

An intervention can be actively published and shared on social media, or receive no attention.

no presence ●—————● presence

Similar to press attention, the coverage of an intervention on social media can support discovery and understanding. While the designers and researchers of an urban visualisation intervention can attempt to foster such social media presence by creation accounts and posts about the intervention, it is generally difficult to influence the level of coverage a project receives from others.

#### Role initiator

The initiator of the project (e.g. the researcher or artist) can be highly involved, or they can distance themselves.

involved ●—————● distanced

Involved initiators can help increase engagement, for example by actively encouraging people to take part. However, if the project is research purposes, involvement of the initiator can influence the results and consequently the study may no longer provide ecologically valid findings.



### 10.3 Applying the frameworks

The set of frameworks described in the previous sections can be used to support the process of designing and deploying urban visualisation interventions. The following steps outline how the frameworks can be consulted to inform this process:

- Step 1:** Identify the type of engagement the intervention is meant to evoke, options are listed in the Engagement framework (Figure 10.1)
- Step 2:** Using the Engagement framework (Figure 10.1), identify the corresponding phase
- Step 3:** Using the Factors framework (Figures 10.2, 10.3, 10.4, and 10.5), find out which design and contextual factors have been found to impact this engagement phase
- Step 4:** Using the Dimensions framework (Figure 10.6) and the corresponding descriptions (Section 10.2), consider how each factor can affect engagement. Determine for each factor what the most suitable approach for the intervention is.
- Step 5:** Consider the importance of the other engagement behaviours for the intervention. If these behaviours are required, repeat Steps 2 to 4.

It should be noted that all four engagement phases are of importance for the success of an urban visualisation intervention. The encouragement of *interaction* should, for example, also involve design considerations around how to facilitate *discovery* and *understanding* – otherwise the interactions will either not take place at all, or they will be meaningless. However, Steps 1 to 4 allow designers and researchers to emphasise aspects of the intervention design and deployment in order to elicit specific engagement behaviours.

To demonstrate in detail how the frameworks can guide the design, development, and deployment of urban visualisation projects, a hypothetical use case is outlined in the following section.

**Use case: Community consultation**

**Initiator:** local residents' association

**Objective:** make a community-led decision on the future use of a community centre by allowing residents to submit ideas. The decision will be informed by the most popular suggestions.

**Setting:** neighbourhood

**Applying the frameworks:**

**Step 1:** The main type of engagement the intervention is meant to evoke is *submitting*.

**Step 2:** *Submitting* is a behaviour that is part of the *interaction* phase

**Step 3:** The Factors framework indicates that to facilitate interaction, several design and contextual factors should be considered:

- The inclusivity and presentation of the topic
- The number of entry points, form factor, input mechanism, and playfulness of the input
- The materiality and size of the output
- The placement and positioning within the location
- The established leaders and social connectedness within the community
- The role of the initiator

**Step 4:** The Dimensions framework and descriptions highlight some key considerations that should be taken into account.

The focus of the intervention is on a single **topic**, the future use of the community-centre, which will be *presented* continuously throughout the deployment. The phrasing of the exact question should primarily be accessible for local residents – and the *inclusion* of visitors or other non-local people is not a priority for the residents' association. Therefore, the phrasing of the topic can be made more specific and less accessible.

The intervention is part of an open-ended consultation and therefore the installation should facilitate the submission of qualitative **input**, such as textual or audio responses.

These types of *input mechanisms* are typically more complex, and because of this the design needs to be carefully considered to enable people from different ages and backgrounds to participate. One option would be to leverage people's familiarity with existing input mechanisms and *form factors*, such as microphones, and to develop custom input devices that mimic this type of interaction. A standalone microphone with a large red record buttons could, for example, be built, that would allow people to submit ideas verbally. However, the nature of the consultation is serious and the collected data will have implications for the neighbourhood. Because of this, the input should not be made too *playful* as this can deter interaction. For the consultation it is also important to allow many people to interact – ideally all local residents. The use of a *number of entry points* can enable simultaneous interactions.

Suggestions submitted via the microphones could be transcribed automatically and presented using a public **output** channel. This feedback could be displayed at the same locations as the input. However, as the consultation addresses a specific physical location – the community centre – it may be more effective to present the suggestions in-situ, at the location of the community centre. The suggestions could, for example, be projected on the façade of the centre, to encourage people to envision how the building could be appropriated for these new uses. Word size could indicate the popularity of each idea. Key to participation is the *materiality* of the output, and its *size*. The use of a projection, as opposed to a digital screen, decreases the likelihood of display blindness.

As the intention of the project is to make a community-led decision, the involvement of the wider community is key. Therefore, these devices could be *placed* in key **locations** in the neighbourhood that are frequented by many people, such as shops, churches, school, railway stations, and the community centre. Where possible, the devices could be *positioned* in places that ensure they are embedded in existing practices (e.g. till of shops, entrance of church, meeting table of community centre, etc.).

Using a single output location may also help create a central place for reflection and discourse, as it will encourage members of the **community** to convene. *Established community leaders* could be involved, who may be able to use their existing network to motivate

more people to interact. Furthermore, as the intervention will take place in a neighbourhood setting, the pre-existing *social connectedness* can encourage collaborations.

Lastly, the *role of the initiator* should be considered. If the intervention is embedded in existing practices and established leaders have been involved, the active involvement of the researcher or artist may not be required.

**Step 5:** Before people can interact with the intervention, discovery and understanding will have to be facilitated. This means several other factors also have to be carefully considered, including the clarity of the topic, the coupling between input and output, and the potential role of social media and press coverage.

As shown above, the frameworks can help designers and researchers in making informed design choices when preparing interventions. It should be noted, however, that while the frameworks can offer support, they do not act as definite guides to successful engagement, and are instead designed to encourage designers and researchers to carefully consider their design and deployment decisions. As demonstrated in the case studies described in this thesis, in-the-wild deployments are often complex, with a variety of different – often interdependent – factors impacting engagement. The set of frameworks is designed to help navigate these complexities by providing a structured way of approaching the key design and contextual factors that will affect the intervention's success.

## 10.4 Contributions and future work

The review of previous deployments of public visualisations in urban settings showed two main gaps in this area of research: a lack of empirical studies and a lack of generalisable knowledge, such as guidelines, frameworks, and taxonomies. Through a series of in-the-wild case studies, this thesis has presented a body of empirical work that highlights the potential of urban visualisation interventions as tools for supporting community engagement with local issues. Furthermore, the detailed documentation of the design, deployment, and evaluation of these projects enables other researchers to build on this work. While previous publicly situated visualisation projects and studies by various artists and researchers (e.g. Dalsgaard and Halskov (2010); Evans et al. (2009); Vande Moere and Hill (2012); Valkanova et al. (2014)) provided initial insights into how best to design these types of interventions,

this thesis has contributed to this knowledge by developing a more systematic approach to designing urban visualisation interventions, building on previous work within the domain of ambient displays (e.g. Pousman and Stasko (2006); Tomitsch et al. (2007)).

The thesis has also highlighted a number of emerging research questions that fell outside of the scope of this work. A limitation of the presented case studies is their relatively short duration – ranging from one-day deployments to one-month deployments. How publicly situated input and output technologies can engage people over a longer time is currently unknown. How could installations support participation in more sustained public discourse around topics that are more long-lasting and less current? Studies of longer durations could also investigate the role of the novelty effect in public settings, and examine how the design of installation could help maintain interest levels (for example by fostering anticipation).

Furthermore, while the case studies were set in a variety of public and semi-public settings, including events, neighbourhoods, and a workplace, the work has been limited to a small number of urban settings in the United Kingdom. Future work is required to establish how the findings generalise across settings in different types of communities, neighbourhoods, cities, and countries. It is likely that additional design and contextual factors will be uncovered in other settings and the presented frameworks are therefore meant to act as a starting point for the further exploration of factors.

In addition, this work raises questions about the role of data in public settings. The studies in this thesis have shown how situated displays of data can encourage a series of – generally positive – engagement behaviours. However, the impact of such public visualisations should be considered with care, as data can also emphasise differences or uncover unexpected discrepancies.

Finally, this thesis has demonstrated that urban visualisation interventions can support a wide range of objectives, from evaluating events to sparking neighbourhood-wide conversation, and conducting community consultations. This highlights another key question: how can these interventions become more attainable for localised or citizen-led efforts? In their current state, many of the employed technologies are not accessible enough to support community-driven initiatives, as they are typically expensive and require technical skills. How could urban visualisation interventions be used to aid local action, increase accountability, or motivate community-wide behaviour change?



## Chapter 11

# Conclusions

This thesis has explored the role of urban visualisation interventions in public settings, and how such interventions can be designed and deployed to facilitate engagement with local topics. This research has been motivated by the increase in popularity of community technology studies which have been conducted in response to studies indicating there has been a decrease in social connectedness in cities. Previous work has shown that two types of technologies have played a key role in engaging people in public settings: public input devices and public displays. These technologies have evoked diverse types of engagement, including: participation, collaboration, and discourse. More recently, artists and researchers have started to explore how the combination of these technologies can enable people to publicly provide feedback and to publicly view the responses from others. This thesis defines these efforts as ‘urban visualisation’: the public and situated collection and display of local or hyperlocal data in the urban environment. The objective of these interventions is typically to create awareness (for example by exposing people to energy consumption data), encourage participation (for example by motivating people to communicate their opinion by voting), and to foster social interactions (for example by deploying the intervention in social spaces that facilitate collaboration and discourse). This work, however, has been piecemeal, and from the literature review two gaps in research emerged: a lack of empirical studies and a lack of generalisable knowledge that can support designers and researchers, such as guidelines, frameworks, and taxonomies. This thesis aimed to address these gaps, with the aim of developing a more systematic approach to designing urban visualisation interventions.

Using an iterative approach, this thesis examined urban visualisations in six empirical studies. Specifically, the thesis investigated: a) the types of engagement that urban visualisation interventions can evoke, b) the design factors that affect this engagement, and c) the contextual factors that affect this engagement. An in-the-wild approach was employed in order to study the input technologies and output visualisations in their intended settings: the urban environment. A variety of locations were used, including neighbourhood settings (Chapter 4 and 9), event settings (Chapter 5, 6, and 7), and a workplace setting (Chapter 8). Similarly, different input technologies were deployed, including voting devices (Chapter 4 and 5), textual input devices (Chapter 8 and 9), and mixed input devices (Chapter 6 and 7). Furthermore, several types of output designs were used, such as non-digital data representations situated on pavements and walls (Chapter 4 and 5) and digital displays situated on stand-alone installations (Chapter 6, 7, and 8).

The contribution of this thesis is twofold. Firstly, by documenting six case studies, this research has provided insight into the design, development, deployment, and evaluation of urban visualisation interventions. The findings from these studies demonstrate how situated input technology and output displays can evoke varying levels of engagement, from curiosity, to interaction, collaboration, and discourse on local topics. Furthermore, these studies shed light on how urban visualisation installations can support existing practices – such as social inclusion activities by community groups, attendee surveying by event organisers, and community consultations by city councils – while simultaneously offering novel functionality: providing insight into the collected data via public visualisations.

Secondly, the collective insights from the case studies have informed the development of a set of urban visualisation frameworks, which are presented at the end of the thesis (Chapter 10). The Engagement framework maps the types of engagement the installations evoked, that emerged in four engagement phases: the discovery, understanding, interaction, and sharing phases. The framework visualises the 14 distinct types of engagement that emerged from the case studies, ranging from people noticing the installations to people championing the interventions by actively encouraging others to participate. The Factors framework identifies all 26 factors that were found to affect engagement. These factors relate to the design of the intervention (i.e. the topic, input, and output) and the deployment context of the intervention (i.e. the location, community, and other contextual aspects). Importantly, the framework



outlines the role of these factors in the four stages of engagement, to enable designers and researchers to adjust the design and deployment of an intervention to evoke specific types of engagement. A separate Dimensions framework illustrates the dimensions of each factor. Based on the findings, the thesis describes which implementations of the factors have been found to work best in which settings. These contributions are aimed at supporting researchers and practitioners working within the areas of HCI, urban computing, and public visualisation. Future work is required to further investigate the impact of the identified factors in different settings, and to explore in more detail how the urban visualisation interventions can evoke engagement. This thesis has demonstrated that urban visualisation installations, consisting of public input and output, are a promising approach for supporting social interactions between members of urban communities, by encouraging people to share perceptions on local topics.



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# **Appendices**





## Appendix A

### Preliminary studies

Two preliminary studies were used to investigate, firstly, people's responses to an existing public display, and secondly, the process of identifying topics relevant to the local community at the start of a deployment. The objective of these studies was to get initial insights into working with communities, and the factors that influence people's engagement with publicly situated technology. These insights could then be used to inform the subsequently conducted case studies.

The first study examined a situated display of crowd-sourced contributions: The Waiting Wall. The project was developed by artists from Free the Trees <sup>1</sup> in an attempt to encourage people to anonymously share their private thoughts on a large public screen. The artists' intention was to evoke compassion and connectedness, by exposing people to the feelings of others. This first study was used to explore the engagement of passers-by with an existing public display in a popular public setting: a railway station. How many people noticed the installation? Did they read or discuss the displayed messages? Did they contribute to it? A summary of the submitted messages was provided by Free the Trees, and analysed by the researcher. The observational data was collected and analysed solely by the researcher.

The second study examined the process of starting a community project by organising a local workshop. The workshop, coined 'Data What?!', aimed to encourage members of the local community to think about ways in which technology and data could be used to support the community during the regeneration process of their area. This second study was used to explore how topics of local importance can be surfaced through the presentation of example

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<sup>1</sup><http://freethetrees.co.uk/>

projects, an interactive data exploration application, and the use of theme cards as probes. The Data What?! workshop, which was co-led by Dr Hans-Christian Jetter (ICRI Cities, UCL) and the researcher. Additional support was provided by Dr Clare Melhuish (Urban Lab, UCL; background knowledge of community, organisation of workshop, recruitment, observations during the workshop), Pedro Monteiro (ICRI Cities, Intel; organisation of workshop, recruitment, observations during the workshop) and Han Pham (ICRI Cities, Intel; organisation of workshop). The room for the workshop was provided by Brixton Green, a non-profit community benefit society. The mobile application used during the workshop was developed by Oscar Robinson and Jonny Manfield. All data collection and analysis described in this thesis was conducted solely by the researcher.

## A.1 Study I: The Waiting Wall

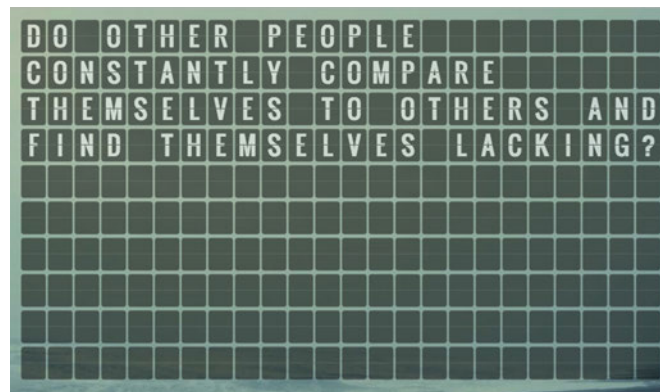


**Figure A.1:** The Waiting Wall in Brighton station

### A.1.1 Introduction

For centuries, the religious practice of praying has brought people together to privately or publicly worship. One example of such a place of worship is the Wailing Wall. This wall, also known as the Western Wall, is a holy site in Jerusalem, believed to be the only remnant

of the Temple Mount. The wall is frequented by Jews for prayer and pilgrimage, and during this process people place paper notes with prayers into the cracks and crevices of the wall. Annually, over a million notes are left in the Wailing Wall. Inspired by this custom, philosopher and writer Alain de Botton suggested creating “an electronic version of *The Wailing Wall*... would anonymously broadcast our inner woes... The wall would offer a basic yet infinitely comforting – public acknowledgement that ... none us are alone in the extent of our troubles.” (De Botton, 2012). Inspired by this idea, Alan Donohoe and Steven Parker (Free the Trees) developed a website allowing people to submit confessions and secrets anonymously. These messages were then shown on a digital split-flap display on the website. In addition, this digital split-flap display was broadcast on an advertisement screen at the Brighton (UK) train station for one week as part of the Brighton Digital Festival.



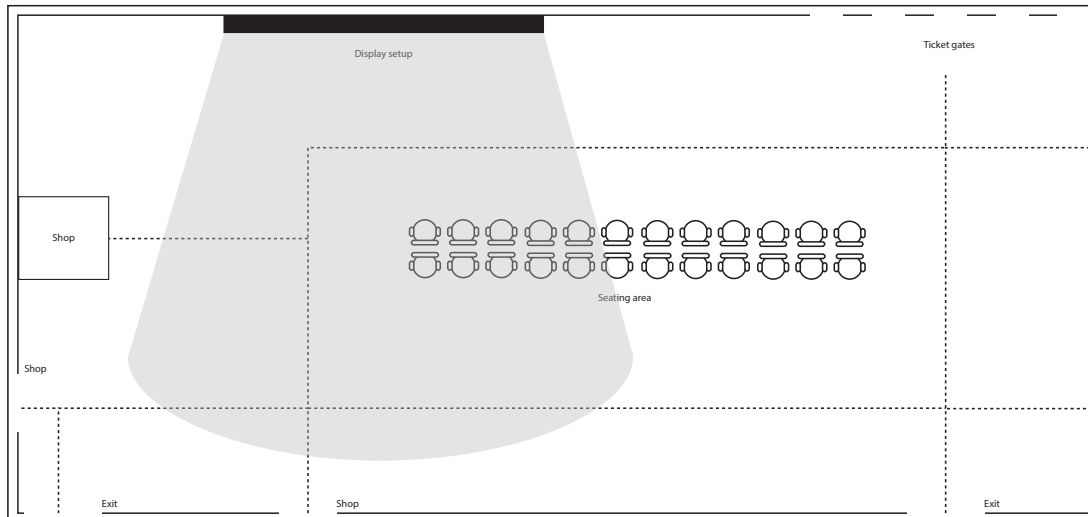
**Figure A.2:** The Waiting Wall was given the visual appearance of a split-flap display with rotating alphanumerical characters

As a preliminary investigation of the engagement with a public display of personal contributions in the urban environment, a one-day observational study of this deployment was conducted. The main objective was to study: a) people’s responses to a publicly situated display broadcasting crowd-sourced thoughts, and b) pros and cons of the use of a set-up like the Waiting Wall, where input is collected via a website and then broadcast on a pre-existing public display.

### A.1.2 Study set-up

The Waiting Wall was broadcast on a 5.3 meter by 2.6 meter JCDecaux digital display that is centrally situated in the Brighton Station arrivals and departures area. The display is positioned above ten smaller displays showing information about train arrivals and departures,

as shown in Figure A.1. The area around the displays is typically crowded, with many people checking train times and waiting for platform announcements. A seating area near the displays allows 24 people to sit while waiting.



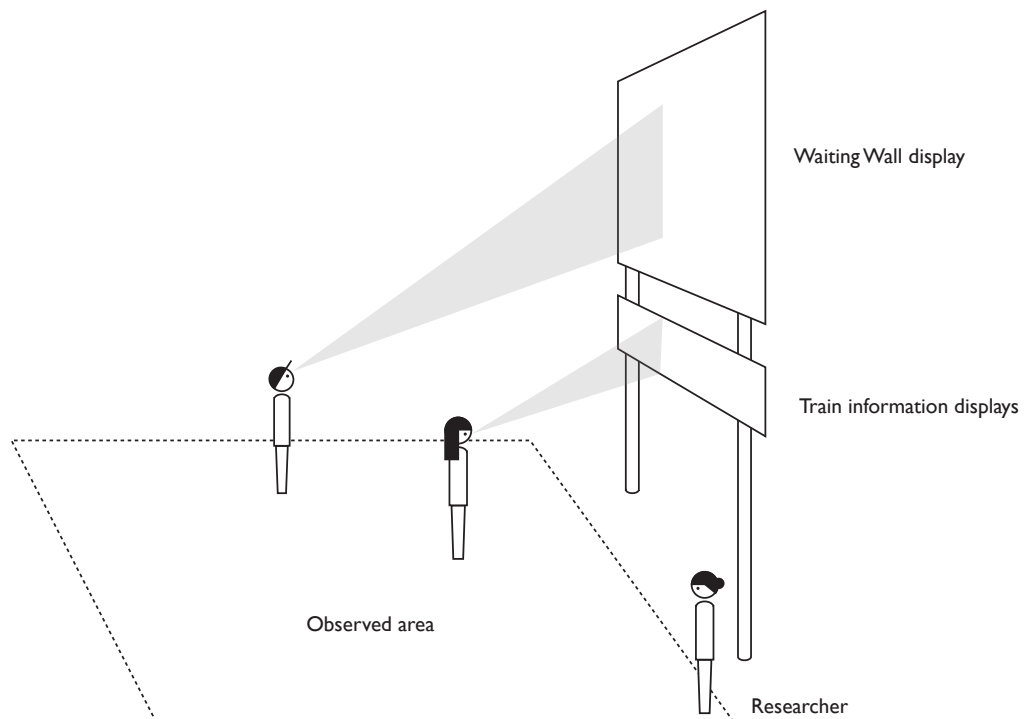
**Figure A.3:** Map of Brighton station showing the display set-up, the area from which the large display is visible and legible (grey), and the key walkways (dashed lines)

The large display shows different advertisements in sequence, on a loop, throughout the day. On this specific Saturday, ten 20 second videos were broadcast. Three of these displayed news items, and six showed various commercial products, including beers, bank accounts, air travel tickets, and fast food products. One slot was taken up by the Waiting Wall. The Waiting Wall was made to look like an electromechanical split-flap display, historically often used to show public transport information in stations and airports. To mimic the visual appearance of a split-flap display the Waiting Wall showed rotating alphanumerical characters, revealing the individual submissions in sequence. Three submissions were shown per broadcast, followed by an information page with the Waiting Wall URL. There was no explicit call to action on this information page. Throughout the day, the same three submissions were displayed every 3 minutes, contrary to how the project was presented in the media, where it was suggested that the display would update in real-time. The following three submissions were shown:

1. *"I'm with someone but in love with my best friend. He doesn't know but he has my heart in the palm of his hand."*
2. *"I'm so scared I'm going to die alone"*

3. *“Do other people constantly compare themselves to others and find themselves lacking?”*

The observational study took place on a Saturday, for 5 hours, from 09:30 to 14:30. During this period, the researcher was positioned near the large display and the primary waiting area. During the Waiting Wall broadcasts, the researcher counted the number of people who were looking directly at the large display. At regular intervals the researcher counted the number of people facing the display set-up and the number of people looking at the train time information displays. Due to the distance between the small information displays and the large advertisement display, it was possible to easily determine from people’s head tilt and gaze whether they were looking at the train information or the Waiting Wall broadcasts, as depicted in Figure A.4.



**Figure A.4:** The researcher was positioned near the display and observed the number of people who directed their gaze at either the large advertisement display, or one of the smaller train information displays

### A.1.3 Observations

During the 5 hours of observations, the area in front of the display was constantly crowded with a diverse mix of people, including families, business people, older people, and teenagers. Due to the transient nature of the railway station a stream of people was continuously passing by. Those who spent time looking at train times, waiting for platform

announcements, or waiting for people arriving all spent no more than 5 to 10 minutes in front of the displays. The vast majority of people spent less than 5 minutes in this area of the station, with a large number immediately leaving after having read the information on the train time displays.

Time	Number of people facing the display set-up	Number of people looking at the information displays	Number of people looking at the Waiting Wall
10:00	20	10	0
11:00	20	12	0
11:30	30	12	2
12:00	25	8	0
12:30	35	16	0
12:45	45	15	0
13:00	17	5	0
14:00	25	8	0
14:30	36	9	0

**Table A.1:** Log of observations of people looking at the display set-up

Despite the continuous flow of people, and the steady number of people standing or sitting near the displays, very few looked directly at the advertisement display. From the observations it emerged that approximately 20 to 40 people were facing the display set-up at all times (see Table A.1). Of those people, approximately 5 to 15 were specifically looking in the direction of the displays. However, most, if not all, of these people were looking at the train time displays — not the advertisement display. Throughout the observation period, no more than 2 people were observed looking at the Waiting Wall broadcast at the same time. During most Waiting Wall broadcasts, no one in the station was looking at the advertisement display.

On three occasions, people were observed actively engaging with the Waiting Wall:

On the first occasion, a man in his mid-twenties read Submission 1, chuckled, and elbowed the man in his company to encourage him to read the messages too. They both read Submission 2 and 3, but did not discuss them. They left for their train shortly afterwards.

On the second occasion, a man in his forties noticed the Waiting Wall and asked his family members (a group of 4) “*What is that? Up there?*”. However, his family members were busy finding out when their train was due to depart and they did not respond. While waiting, the man did not bring it up again, and did not look at the display again.

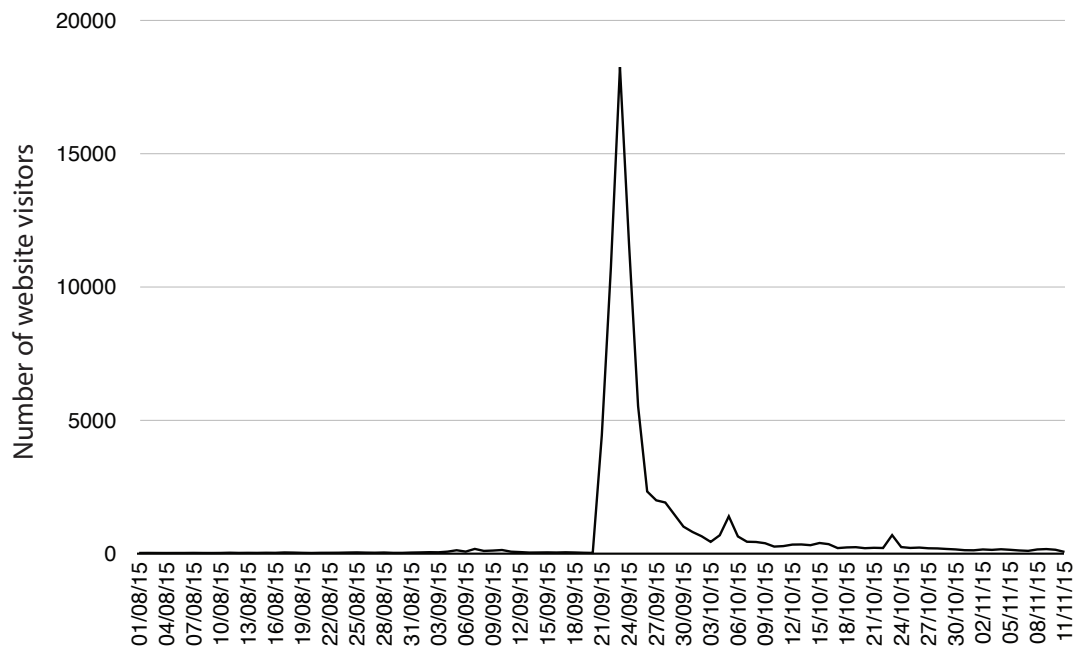
On the third occasion, a man in his mid-30s walked past the screen, looked up, and noticed the Waiting Wall. He attempted to make his friend — who was walking ahead of him — aware of the display and called out to him. The man then noticed an advertisement had now replaced the Waiting Wall on the screen and immediately stopped calling out to his friend. Neither looked at the display again, and shortly afterwards they left the station.

#### A.1.4 Usage data

The team behind the Waiting Wall provided summaries of their data for this research. In total, 13,916 messages were submitted to the Waiting Wall. Of those, 5,628 messages (40.4%) were classified as inappropriate by the team. The team had a variety of definitions of ‘inappropriate’, including messages that were *“only submitted to shock”*, *“not genuine”*, *“daft”* (e.g. jokes about the prime minister), response messages (e.g. giving advice to other submitted messages or criticising other messages), spam, self publicity, or messages that contained information that could identify people. Furthermore, a member of the team explained that *“some [messages] just didn’t fit the aesthetic – a vague notion I had, so I suppose I was curating the piece or maintaining its integrity.”*

The remaining 8,288 messages were displayed on the project’s website. These ‘confessions’ generally addressed highly personal issues, with the vast majority touching upon topics such as relationships (e.g. *“I am in love with a man but he doesn’t want my children. I want children. There is no happy ending here.”*), anxiety (e.g. *“I live in constant fear of my shortcomings”*), loneliness (e.g. *“I’ve forgotten what it is like to have friends”*) and health (e.g. *“I want another child but the risk of cystic fibrosis is 1 in 4. Can I risk my future child’s life like that? Would you?”*).

In the period between 1 August and 11 November 2015, the Waiting Wall website was visited from 50,148 unique IP-addresses (23,818 on desktop, 22,844 on mobile, and 3,486 on tablet), as shown in Figure A.5. The website was most popular during the Waiting Wall deployment from 21 September until 27 September, when the project received press coverage from both national and international media. On average, visitors were on the website for 2 minutes and 51 seconds. Of these visitors, 18,542 were based in the United Kingdom, i.e. 37%, followed by the United States (9,188), Netherlands (3,637), Canada (2,124), and 155 other countries.



**Figure A.5:** Number of website visitors per day

## A.1.5 Discussion

### A.1.5.1 Advertisements and display blindness

People familiar with Brighton station, or other big railway stations, have become used to seeing large advertisement displays. As a result, it is unlikely that they expect content that is *not* an advertisement to be broadcast on these displays. This makes it difficult for a project like the Waiting Wall to grab people's attention: people often experience *display blindness*, where their regular exposure to advertisement displays have made them accustomed to them — and as a result they tend to ignore such displays (Müller et al., 2009). The low number of people looking at the large display during the observational study suggests display blindness may have hindered engagement with the Waiting Wall project. Another factor that likely affected engagement is the positioning of the display, as Huang (2007) found that people rarely looked at displays positioned above eye-level. This raises the question: what alternative methods can be used to display information in public settings that will draw people's attention?



### **A.1.5.2 Short display time**

By including the Waiting Wall broadcast in a sequence of 9 advertisements, the chances of someone seeing the Waiting Wall when looking at the screen were only 1 in 10. This short display time further decreased the chances of people noticing the project. When people looked up at the right time, the Waiting Wall was on display for 20 seconds. If they had been enticed to see more of the Waiting Wall, they would have had to wait another 3 minutes to see the next broadcast. These waiting times require a significant amount of patience, especially in a place as transient as a railway station, where most people have a specific and often time critical objective, like catching a train.

### **A.1.5.3 Static content**

When people looked at the display, and waited for Waiting Wall broadcasts, they most likely quickly realised that the content was in fact static; the same set of messages was displayed during each broadcast. This leaves little to no motivation to wait an additional 3 minutes for the next broadcast as there is no anticipation for new content. In addition, the incentive to contribute may have also been affected, as it is likely that people realised that their submitted messages would not be displayed on the station's screen. This raises the question: how can we design for anticipation, thereby potentially sustaining engagement for a longer period of time?

### **A.1.5.4 Call to action**

Although the project's website and the various articles published by the media clearly described the aim of the project, the Waiting Wall broadcast at the station did not have an explicit call to action. The broadcast also did not provide any information about why these messages were displayed, how people could participate, and that the project was an art project — unlike the other broadcasts which were mainly advertisements. Although the three messages themselves may have encouraged people to visit the website, it was implicit. It seems likely that a more explicit call to action could have highlighted the participatory nature of the project.

### **A.1.5.5 Coupling between input and output**

The Waiting Wall broadcast informed people about the submission process by providing them with the project website URL. Inside the station, people who carried a mobile

Internet-connected device (e.g. phone or tablet) could have accessed this website and submitted a message immediately. However, those who did not carry such a device would have had to remember or write down the URL, and participated once they did have Internet access at a later time. In the station, there was no dedicated device that allowed people to submit messages on the spot. One or more situated input devices may have allowed for a more inclusive submission process and these devices could have also acted as additional tools to create awareness of the project by grabbing people's attention at eye level. This raises the question: how can we design installations that combine input and output in manner that clearly communicates the link between the two, the purpose of the project, and how people can participate?

#### **A.1.5.6 Role of media in engagement**

The static content at the station did not attract a high level of engagement, however, in contrast, the project's website attracted over 50,000 visitors, and over 13,000 submissions. Key for this engagement was the press coverage on the project, in particular one major UK newspaper article that "*went viral*" according to the Waiting Wall team. This article was followed up by several other national and international publications, which further increased engagement with the project around the world – though only with its online presence, and not its physical manifestation inside Brighton Station. This engagement can also be seen in the data of the website visitors, which reveal only 37% of visitors were based in the UK, proving that the majority of visitors did not discover the project via the display at Brighton Station.

The observations at the station revealed that very few people took notice of the Waiting Wall messages, further suggesting that overall engagement with the project would have been significantly lower if the project had not been publicised through the media. A longer deployment period would have allowed for a better insight into the role of the media, and how engagement may have developed after this initial burst of press attention.

#### **A.1.5.7 Content curation**

The relatively high number of submitted messages that were deemed inappropriate by the Waiting Wall team, just over 40%, highlights both the difficulty of collecting textual input in this manner, as well as the power of the project's initiators to shape the nature of the

displayed content. The team behind the Waiting Wall project used a priori moderation and for this research they provided a list of criteria they applied while moderating submissions. However, this list was created during the moderation process, and no outline of criteria was provided to people prior to message submission. Furthermore, the team disclosed that they also applied more subjective reasons for allowing or refusing submissions, related to the intended aesthetic of the project. This reveals an additional tension that surfaces when projects are developed with an artistic goal in mind, and as a result may be actively influenced by the creators in order to fulfil their artistic ambitions and expectations.

### **A.1.6 Summary**

The Waiting Wall was a week long deployment by artist group Free the Trees at Brighton Railway station, providing a public forum for people to share thoughts and confessions. Messages could be submitted via the project's website, and the submissions were also displayed on this website. Furthermore, a large advertisement display at the station was meant to engage people in participating by showing Waiting Wall broadcasts.

While the project received a high number of submissions, the vast majority of these were in response to media coverage rather than motivated by the display situated at the station. The observational study revealed that several factors may have acted as barriers to participation, including display blindness, the short broadcast periods of the Waiting Wall, the static content, and the accessibility of the input technology. The disconnect between the input technology (i.e. website) and output technology (i.e. display at station) raises questions on how to best combine the two in a situated manner, in order to make it obvious what the purpose of the project is, how people can contribute, and how they can view the contributions of others. Furthermore, the study also raises questions about alternative display methods in public settings that combat display blindness, the accessibility of input technology, and designing for anticipation in order to foster engagement.

## **A.2 Study II: Data What?!**

### **A.2.1 Introduction**

At the time of this study, Somerleyton Road, a residential street in the Brixton area of London (UK), was in the process of undergoing regeneration. As part of this scheme, the local council of Lambeth collaborated with Intel / ICRI Cities, who placed several air quality

sensors in the area to investigate how the regeneration process would affect the air quality on Somerleyton Road. Intel/ICRI Cities approached researchers within ICRI Cities to find out if anyone was interested in engaging with the community in this area, building upon their existing social connections. The work described in this section is a collaboration between Dr Hans-Christian Jetter and the researcher, supported by Han Pham (ICRI Cities, Intel), Pedro Monteiro (ICRI Cities, Intel), and Dr Clare Melhuish (Urban Lab, UCL). For more information about this collaboration, see Section 3.5.

To start the engagement with the community, it was collectively decided to organise a workshop for members of the local community to learn more about the area and the ways in which technology and visualisations could potentially be used during the regeneration process. Therefore, the key research question during this study was: how do we find out what topics are of importance in this community?

### **A.2.2 Setting**

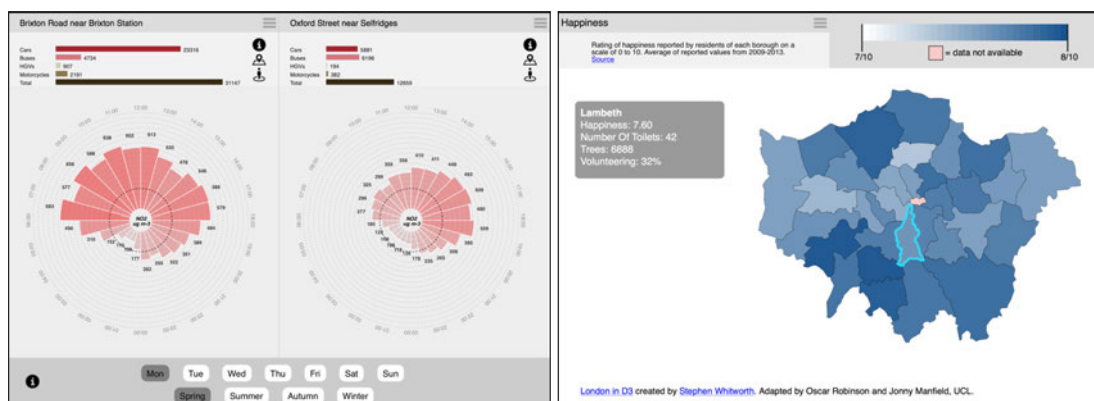
Somerleyton Road was built in the 1870s and originally featured a row of Victorian buildings. In the 1970s these were all destroyed during a redevelopment plan, and replaced with a row of modern houses and a large council estate. In recent years, new redevelopment plans for the area have been made, which will be executed in the upcoming years. Lambeth Council has put in effort to involve the local community in deciding what the future of the road should look like — via so-called community-led development. In a series of consultations, local residents have been asked to provide ideas and feedback to the council. Nevertheless, many locals express concerns over the redevelopment plans, as they believe the people currently living in the Somerleyton Road area will no longer be able to afford living in the area once new housing has been built.

### **A.2.3 Set-up**

To investigate whether a “community in change”, like the Somerleyton Road area, has any specific data collection interests or ideas around what data could be useful for them to see during this process, the researchers organised the ‘Data What?’ workshop. The event had several goals. Firstly, the objective was to introduce the attendees to more creative data projects conducted around the world — in an attempt to try to steer the conversation away from “typical” urban data (e.g. bus arrival times, house prices, etc.). Secondly, the aim was

to enable attendees to explore local data via a custom visualisation, thereby allowing them to learn something new about their neighbourhood while also being introduced to different visualisations. Thirdly, the workshop was designed to get the attendees to think about what data would be useful or interesting to have — and in what shape or form they would like to have it. To cover these three goals, the event was split up into four phases:

**Phase 1: Introduction to data projects** – A 15-20 minute presentation on the general concept of data and different urban data visualisation projects conducted in recent years, including digital visualisations (e.g. London jogging map (Barsukov, 2014), London language map (Lansley, 2004) and outdoor visualisations (e.g. Nuage Vert (Evans et al., 2009), Tidy Street (Bird and Rogers, 2010), Simon Heijden’s Tree (Heijdens, 2004), and Mégaphone (Fortin et al., 2014b)). All projects were briefly described, including their goals, method and (when-ever available) outcomes. The key aim of this phase was to introduce people to a diversity of projects, inspiring them to think beyond typical urban data and to instead discuss alternative, sometimes even playful, applications of data.



**Figure A.6:** Left: iPad application for exploring air quality data. Right: iPad application for exploring various data sets of London per borough.

**Phase 2: Data exploration** – A 10 minute presentation on air quality (nitrogen dioxide specifically) followed by a guided exploration of the web application developed by ICRI interns. The idea was to use air quality as an example of local data, to get people to think about other types of data they would like to have for Somerleyton Road. The application allowed people to directly compare nitrogen dioxide ( $NO_2$ ) data from two locations in London (see Figure A.6). Data from the London Air Quality Network<sup>2</sup> was used, comparing a total of four different locations: Brixton (sensor near busy road), Oxford Street (reportedly street

<sup>2</sup><http://www.londonair.org.uk/>

with worst air quality in UK <sup>3</sup>), Regency Place (suburban area) and Bushy Park (green area). A radial visualisations allowed people to see differences over time: aggregated per hour, day of the week, or season. Furthermore, the visualisation showed traffic data for each area, allowing for comparison between the air quality and the prominence of different types of vehicles. After this guided exploration, attendees of the event were asked to further explore the visualisation. They were encouraged to share any interesting findings.

*Phase 3: What data matters to you?* After presenting a wide variety of data projects and exploring a highly specific dataset (air quality), the main goal was to find out what data residents of Brixton found relevant to their lives. To foster discussion on a broad range of topics, attendees were given ‘theme cards’ as probes (see Figure A.7). On these cards, a variety of icons were depicted, ranging from defined topics (e.g. nature, traffic, food) to more ambiguous themes (e.g. people, smiley face). These more ambiguous representations were designed to encourage people to discuss topics they associated with these icons, in particular topics beyond the imagination of the researcher. All participants were provided with markers and flip charts, to enable them to write down any comments and ideas.



**Figure A.7:** Data What?! theme cards, icons sourced from the Noun Project <sup>4</sup>

<sup>3</sup><http://www.airqualitynews.com/2014/07/07/oxford-street-air-pollution-highest-in-the-world/>

<sup>4</sup><http://thenounproject.com/>, specifically: Soccer ball by Laurent Patatin, Police by Luis Prado, Music by Edward Boatman, Car by Andrew Cameron, Vaccine by OCHA Visual Information Unit, Happy by Mateo Zlata, Bicycle by Edward Boatman, Tree by Tin Phatanapirom, Community by Rémy Médard, Polling place by Iconathon, Shopping cart by Castor and Pollux, Restaurant by Andreas Larsen, and Pound by James Fenton.

Phase 4: *How could we communicate such data on Somerleyton Road?* In the final phase of the workshop, participants were encouraged to think about how the data ideas generated in Phase 3 could be communicated to them. The participants were reminded of the creative and playful data projects presented in Phase 1 and asked to write, draw or create any visualisation ideas using the provided markers, paper, and simple craft supplies.

#### **A.2.4 Recruitment**

Recruitment for the ‘Data What?’ workshop was organised by Han Pham, Pedro Monteiro, and Dr Clare Melhuish. Dr Melhuish had previously been involved in a series of activities organised in the Somerleyton Road area, and because of this she was able to book a room in the local community centre for the workshop. As numerous workshops have taken place at the community centre in recent years, it was decided the word ‘workshop’ should not be mentioned explicitly in any of the recruitment materials. Instead, it was referred to as an ‘event’ and ‘creative evening’, to avoid the association with typical consultation workshops and to communicate the informal nature of the evening.

Local residents and people actively involved in the Somerleyton Road community were approached in two ways. During a community fair, the researchers were present with posters and flyers (see Figure A.8) and actively approached people attending the fair. After the fair, dozens of extra flyers were left at the community centre.

Flyers were also distributed to people attending a popular public screening of a sports event in the community centre. In addition, a list of approximately 40 locally active people was curated by the researchers and volunteers at the community centre. All people on this list were sent an invitation by e-mail. Despite these efforts to reach many people, only a small number of people signed up for the workshop – approximately 10, while the target number was 40 participants across two workshops. Whether this was due to a lack of interest in the event, general apathy towards ‘another workshop’, timing (the event took place during the school holidays), or because of other reasons remains unknown. It does, however, reveal the challenges that come with involving residents in local projects, and the effort that may be required to reach out to the wider community.

Initially, it was decided that there would be two separate workshops. One for active community organisers and people professionally engaged in the Somerleyton Road community (e.g. council employees) and one for local residents. However, because only a handful of



**Figure A.8:** Data What?! recruitment flyer

people signed up for the first event, these two groups were merged and only one workshop was organised.

### A.2.5 Workshop

The 'Data What?' workshop took place on 18 July 2014, from 18:30 until 20:45. In total, 13 people showed up and took part – below the target number of 20 participants per workshop. The room in which the workshop was organised contained four tables, and people were free to select a place to sit. An overview of the participants and table arrangements can be found in Table A.2.

The planned structure of the workshop was maintained — though time restrictions meant that the final phase had to be skipped. This was a conscious decision, as the rich discussions between the participants were viewed as highly informative and useful by all researchers. Phase 1, the introduction to data projects (led by the researcher), was meant to present people to a wide variety of types of data and visualisations. During this phase there were few comments or questions. One participant asked two questions, generating some discussion. The first question related to the data presented in one of the presented visualisations (Tree Heijdens (2004)). After understanding the visualisation better, she said that she found the



Table	Participant	Sex	Occupation
Table 1	Participant 1	M	Council employee
	Participant 2	M	Council employee
Table 2	Participant 3	M	Visiting professor (invited by Intel)
	Participant 4	M	Artist, also volunteers for community centre
	Participant 5	F	Artist
Table 3	Participant 6	F	Employee community centre
	Participant 7	F	Pupil at local primary school
	Participant 8	F	Student
	Participant 9	M	Unknown
Table 4	Participant 10	M	PhD student
	Participant 11	M	Council employee
	Participant 12	M	Volunteer at community centre
	Participant 13	F	Garden designer

**Table A.2:** Overview of participants

project visually unappealing and that she did not emotionally connect to it in any way. This resulted in a brief discussion amongst all participants, many of whom responded by saying that liking or disliking the visualisation is highly subjective. The same participant later asked for clarifications around what constitutes as data — which again sparked brief discussion about the ambiguity of the concept ‘big data’. A council employee remarked that to them “*data becomes valid when someone uses it*”.

**Figure A.9:** Data What?! setting



when the icon of a football was presented to them, they only considered ‘football’ as the topic and not the broader theme of sports. All groups decided to spread the theme cards over the available paper and to then annotate the cards. An example of this is shown in Figure A.10. When all groups appeared to have run out of ideas, the tables presented their suggestions to the whole room.

## A.2.6 Discussion

### A.2.6.1 Involving local residents

The workshop primarily highlighted how hard it can be to involve a range of local residents in community projects. Despite significant efforts to reach out to people during the recruitment phase, the workshop’s participants were far from representative of the Somerleyton Road area. The majority of the participants did not live on Somerleyton Road, or even in Brixton. Instead, they were regular visitors of the street, or worked in the area. While many of the participants were knowledgeable about the area, it is difficult to assess whether their comments and ideas would be similar to those of people actually living in the area.

### A.2.6.2 Identifying topics

During the workshop it quickly became apparent that participants found it hard to think beyond the examples given to them, or beyond the mobile applications they were already familiar with. Their suggestions were often highly pragmatic, specific to their personal experiences (e.g. visualising restaurant table availability, queue length at the council office, map to show least polluted route to work), and aimed at directly improving their own life. Few suggestions were made taking into account the needs and wishes of the wider community. Furthermore, there were no clear themes in their suggestions, and therefore the workshop did not succeed in identifying topics of interest to the local community at large. It is likely that this was at least partly influenced by the low participation rate of local residents.

A handwritten note in black ink on a white background. The text is written in a casual, slightly cursive script. It reads: "As a resident, I do not need data to live well."

**Figure A.11:** Comment from a local resident regarding her interest in different data sources

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**Air quality suggestions**


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Map of which areas are most affected by the bad air quality. It could inform kids with asthma, joggers, your route to work, etc.

How could we predict pollution?

Map both air quality and congestion

This data could be relevant when buying property, map water quality, air quality, healthy food on a 3D map

Also show cycling / walking, “maybe [the air quality in] spring is better because people cycle more? Compared to autumn?”

Use different, more understandable units:  $mg^3$  does not mean anything, “what am I exposed to in 10 minutes?”

Overlay it with health data

Potential of legal action, change

Perhaps fountains help absorb pollutants? Perhaps vegetation can affect air quality, and if so, how much? How quickly?

Pollution in the London Underground itself, “*We could compare data from different stations around the world*”

Chemicals from aeroplanes

Going beyond air quality pollutants and also measuring other pollutants and particles, e.g. off-gassing from clothing, household chemicals, cleaners, dust from construction sites

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**Other suggestions**


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Stop and search data

Languages spoken in area

The impact of gentrification: where do people go?

Social coherence

How much money is earned in Brixton and spent elsewhere

Types of food eaten in area

Who are the councillors, what do they do?

Checking restaurant table availability

Variety of shops and how happy people are with this variety

People flow to and from the tube station to avoid area when busy

Property prices and rent levels

Spending power of people in area

Being able to geo-tag rubbish, to inform the council of fly-tipping

Lots of different data to create map to navigate Brixton / London

Perception of safety vs actual safety

Waiting times in the queue for housing benefits, so that you can arrive when it is your turn

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**Table A.3:** Suggestions and comments made regarding the air quality application (Phase 2), and regarding the theme cards (Phase 3)

### A.2.7 Summary

The one-off Data What?! workshop in the community centre of Somerleyton Road was aimed at identifying topics of interest to the local community, that could be publicly visualised in the area at a later stage. The broader research aim was to investigate how to begin a community project. While the workshop went according to plan, and a range of suggestions were made by the workshop attendees, the suggestions were largely limited to themes addressed by the researchers during the workshop (e.g. air quality) and topics that were primarily of personal interest (e.g. house prices) – without taking into account the wider community. While these topics were important to the people concerned, they generally did not go beyond the data already available through existing websites and mobile applications. As a result, the workshop did not bring out topics that could be transformed into a case study, and the engagement with the Somerleyton Road community ended. This preliminary study demonstrates the challenges that come with starting a community project, and attempting to involve the wider community.

## A.3 Lessons learnt

The two preliminary studies provided insight into the challenges that come with engaging people with projects around publicly situated technology.

**Attracting people to participate is difficult:** Both the Waiting Wall and the Data What?! studies revealed that it is difficult to motivate either residents, or passers-by, to dedicate their time and attention to a specific cause – such as a workshop or art project. The Data What?! project revealed that a combination of posters, flyering at a local event, and digital invites does not guarantee high levels of participation. Similarly, the Waiting Wall study demonstrated that appropriating a large display in a crowded setting does not guarantee high levels of participation, as few people may notice the installation. These findings suggest a design opportunity for *publicly situated technology that provokes curiosity*. Rather than having to rely on active recruitment, by designing for curiosity, participation could be evoked in a more natural manner.

**The visibility of displays is key:** The Waiting Wall project revealed that it is important that people are able to easily notice publicly situated displays – meaning their positioning is crucial and should likely be at eye level, or on other surfaces that are looked at frequently,

such as the ground. Furthermore, the displayed content should be visible at all times, and not be obscured by advertisements or other information that deters people from looking at the display again. This reveals a design opportunity for *dedicated displays on eye-catching, alternative surfaces*.

**Public displays could foster engagement over time:** The lack of new content on the Waiting Wall did not motivate people to stay around to look at the display again. This highlights a design opportunity for *displays that foster anticipation, by revealing new content over time*.

**Identifying relevant local topics is difficult:** From the Data What?! workshop it emerged that identifying topics to address using situated technology is a challenging and potentially time-consuming process. The Waiting Wall project overcame this issue by focusing the input and output on a broad and accessible topic, namely ‘private thoughts’, which was not location-specific.

**Participation could be more inclusive:** The Waiting Wall project enabled people to submit their contributions online. The public display, however, was physically situated in the station – where no technology was provided to access the website or to otherwise participate. As a result, participation in-situ required the possession of an Internet-connected phone. This shows a design opportunity for *dedicated situated input technology that is located near the corresponding output*.

**Engagement could go beyond participation:** While the Data What?! workshop fostered in-depth discussions about a wide range of topics, the Waiting Wall display did not evoke situated engagement. By only enabling people to participate using their personal devices, the installation did not encourage people to talk to others around them, despite being surrounded by people. This highlights a design opportunity for *situated technology that encourages situated interactions beyond participation*, such as face-to-face conversations.

## A.4 Summary

This chapter described two preliminary studies which revealed the challenges that come with engaging people with publicly situated displays and encouraging people to think creatively about their personal and communities’ data needs. From these studies, several design oppor-

tunities emerged around the design of inclusive situated technology that evokes curiosity, fosters anticipation, and encourages engagement beyond mere participation.





## **Appendix B**

### **Fair Numbers brainstorm**

Data gathering ideas	Theme
1 Smells (food stalls)	Food
2 Type of food / drink consumption (what flavours are popular?)	Food
3 What food is available	Food
4 Popularity of different food types	Food
5 Calories consumed	Food
6 Pictures (Instagram / Flickr / etc)	Social media
7 Hot topics on Twitter (what people are talking about)	Social media
8 Hashtags and social crowdfsource from Twitter / Instagram / Facebook	Social media
9 FourSquare check-ins in the road + side roads	Social media
10 Time + place + number of people	Crowd
11 Time + place + number of people + food stalls	Crowd
12 Aerial pictures	Crowd
13 Where are people, where not (on the street)	Crowd
14 Number of visitors	Crowd
15 Movement flow of visitors	Crowd
16 Crowdedness / popularity stalls	Crowd
17 Where visitors are from	Crowd
18 Where people are from	Crowd
19 Do you feel safe here	Safety
20 Number of people in the group you're with	Social
21 How many people you've spoken to (bumped into)	Social
22 QR codes in the stores take you to an app to rate it - you can give a gift in exchange	Purchases
23 Cashflow from the stalls	Purchases
24 How much has been sold?	Purchases
25 How much money has been raised (charity)	Purchases
26 Amount of money raised for charity	Purchases
27 Christmas data: gifts bought	Purchases
28 Money spent per visitor	Purchases
29 Money spent	Purchases

Data gathering ideas	Theme
30 Mood	Mood
31 Mood	Mood
32 Mood colour (make use of Mood Squeezer project?)	Mood
33 Christmas mood	Mood
34 How they travelled here	Transport
35 How did you come here? Car, public transport, bike, foot	Transport
36 Distance travelled	Transport
37 Demographic info: visitor or local?	Demographics
38 Demographic info: age	Demographics
39 Age of visitors	Demographics
40 Demographic info: single or not (dating hotspot)	Demographics
41 Temperature	Temperature
42 Heat (crowd + cooking)	Temperature
43 Temperature + number of people	Temperature
44 Light levels	Light
45 Sound levels over time	Sound
46 Sound (how loud...)	Sound
47 Noise	Sound
48 Noise	Sound
49 Ethanol	Other
50 Colour of attendees' clothing	Other
51 Amount of smoke	Other
52 Number of years attended previously	Other
53 Step counts (how far walked)	Other

**Table B.1:** Overview of votes per location

	Data presentation ideas	Theme
1	Coloured smoke	Smoke
2	Project on clouds of smoke	Smoke
3	Peep hole (iPads in some places, showing “collage” of pics on either side of bridge)	Digital screen
4	Display pictures according to tags	Digital screen
5	Map showing movement paths (LED?)	Digital screen
6	Display photos taken by visitors on a screen (collage-style)	Digital screen
7	Dashboard (clock-like)	Digital screen
8	Decorate Christmas trees throughout the day (depending on data)	Christmas tree
9	Projection onto the trees (every tree different colours) (maybe too bright?)	Trees
10	Use street decor (Christmas) input (change colours, etc.)	Street furniture
11	Streetlights	Street furniture
12	Bins	Street furniture
13	Tubes with balls / buttons, popularity of different tubes will have reverse bar chart effect	Physical bar chart
14	Give out rings, people build visualisation themselves	Physical bar chart
15	Fill up clear plastic tubes with fake snow (different colours)	Physical bar chart
16	Fortune cookie stuff - something	Food
17	Project data on food	Food
18	Facade projection (buildings)	Projection
19	House facades (maybe too bright?)	Projection
20	Capture and listen back to whispers (“what do you want for Christmas?”)	Sound
21	Tunes generated based on noise level	Sound
22	Playback of captured sounds (maybe you go into a tent / booth and hear an audio collage)	Sound
23	App (maybe too short time)	Application
24	Balls wall (like King’s Cross), ask people to turn balls to certain colour/pattern	Custom wall display
25	Flying candles (when certain money threshold is reached, X number of candles can be let into the air - will require stall)	Candles
26	Use the t-shirts of the people in the stalls (either wifi t-shirts or white t-shirts + projection)	Clothing
27	Balloons	Balloons
28	For drinks consumption: a device that fills in different glasses according to	Glasses
29	Physical objects placed in the stalls	Other
30	Mountain (physical) as high as number of steps walked	Other

**Table B.2:** Overview of votes per location

## Appendix C

### Publicity

#### C.1 Visualising Mill Road

During deployment:

1. Radio interview on Cambridge 105's '*105 Drive with Julian Clover*', 28 August 2013  
<http://cambridge105.fm/podcasts/105-drive-28-08-2013/>
2. Radio interview on BBC Radio Cambridge's '*The Paul Stainton Bigger Breakfast Show*', 30 August 2013
3. BBC News: '*Cambridge Mill Road chalk graffiti charts scientists' community data*', 30 August 2013  
<http://www.bbc.co.uk/news/uk-england-cambridgeshire-23896544>
4. Cambridge News: '*High-tech study asks whether divide between two halves of Mill Road in Cambridge real or imagined*', 31 August 2013  
<http://www.cambridge-news.co.uk/News/SLIDESHOW-High-tech-study-asks-whether-divide-between-two-halves-of-Mill-Road-real-or-imagined-20130831060500.htm>

After deployment:

5. Cambridge Edition: '*Visualising Mill Road*', October 2013
6. Mill Road Bridges Newsletter: '*Mill Road data project intrigues BBC News*', November 2013 (PDF)

7. Infosthetics: '*Visualising Mill Road: Informing Communities by Infographics in the Street*', 27 February 2014  
[http://infosthetics.com/archives/2014/02/visualising\\_mill\\_road\\_informing\\_communities\\_by\\_visualizations\\_in\\_the\\_street.html](http://infosthetics.com/archives/2014/02/visualising_mill_road_informing_communities_by_visualizations_in_the_street.html)
8. Experimenta Magazine: '*Visualising Mill Road, ICRI Cities*', 17 March 2014  
<http://www.experimenta.es/noticias/miscelanea/grafitis-mill-road-lisa-koeman-cities.io>
9. Fast Company: '*How These Simple Chalk Infographics On The Sidewalk Created A Neighborhood*', 25 March 2014  
<http://www.fastcoexist.com/3027215/how-these-simple-chalk-infographics-on-the-sidewalk-created-a-neighborhood>
10. MetaTrend: May 2014

## C.2 Urban Typewriter

During deployment:

1. Croydon Council: '*Revitalising Ashburton Park*', February 2016  
<https://www.croydon.gov.uk/planningandregeneration/regeneration/ashburton-park-regeneration/revitalising-ashburton-park>
2. Friends of Ashburton Park: '*Ashburton Park Survey*', February 2016  
<http://thefoap.org.uk/>
3. Croydon Advertiser: '*Residents asked for opinions on former library site in Croydon*', 12 March 2016  
<http://www.croydonadvertiser.co.uk/undefined-headline/story-28897437-detail/story.html>
4. Inside Croydon: '*Ashburton's councillors are making plans for park life*', 17 March 2016  
<https://insidecroydon.com/2016/03/17/ashburtons-councillors-are-making-plans-for-park-life/>

## **Appendix D**

### **Urban Typewriter Croydon Council report**





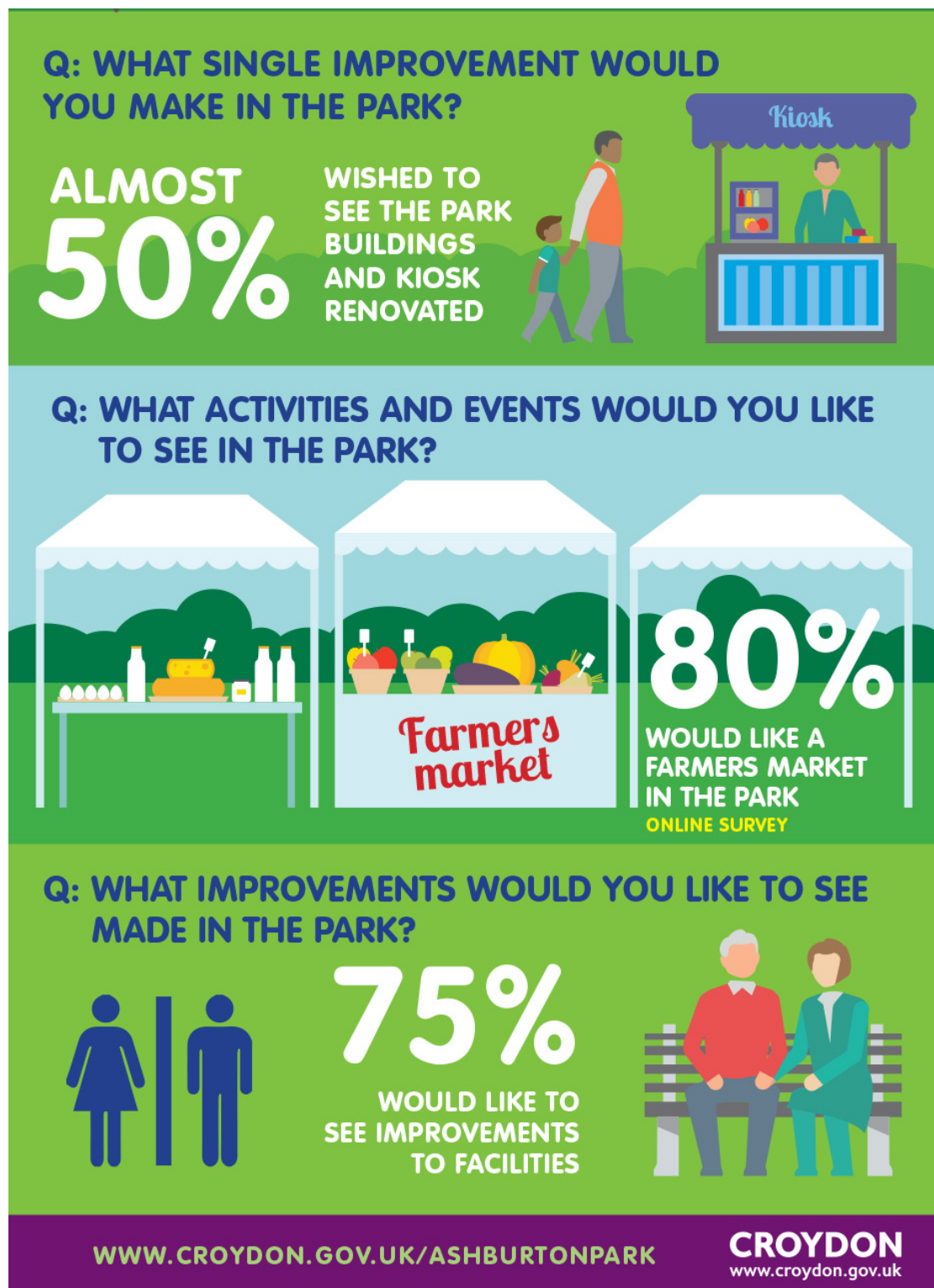


Figure D.1: 'Snap shot' report by Croydon Council



# Glossary

**community** the more or less voluntary assembly of citizens who share single (or perhaps plural but seldom all) aspects of life (as defined by de Waal (2014)).

**community engagement** active engagement by a community at large.

**community technology** technology situated in public settings such as high streets, squares, and parks that aims to engage the community living or working there.

**engagement** the experience of being actively involved, as evidenced by behaviours such as observing, participating, and discussing.

**hyperlocal** relating to or focusing on topics concerning a small community or geographical area.

**local topic** theme or question that is highly specific to the context in which it is addressed, relating to the immediate surroundings.

**neighbourhood** geographical area district or community within a city.

**participation** the action of taking part in something (e.g. taking part in civic discourse or expressing opinion via voting device).

**public visualisation** situated display of data in public space.

**urban** in, relating to, or characteristic of a city.

**urban visualisation** the public collection and visualisation of hyperlocal data in cities.

**visualisation** display of data, typically graphical (e.g. chart).